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# Highway Safety Literature

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U.S. Department of Transportation National Highway Traffic Safety Administration

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**SPECIAL ADJUDICATION FOR ENFORCEMENT (SAFE)****First Annual Report****Technical Summary****February 1976**

by

Donald G. Morehead and Michael Wood

**ABSTRACT**

This technical summary is intended to provide an overview of the project operations and impact. It includes a step-by-step history of how the program operations were implemented. Persons in the field of traffic safety who are considering the implementation of similar operations within their own communities will find this summary a helpful reference document. However, the reader is cautioned that the project results reflect only a year of operations and that more time is required before a fully adequate evaluation of project impact may be conducted.

**TECHNICAL SUMMARY****A. Project Objectives**

The Seattle SAFE project has been organized to demonstrate and evaluate the value of a noncriminal driver adjudication and improvement process. Being tested are techniques and sanctions designed to improve deterrence and reduce traffic violator recidivism. The project is structured to operate as a subsystem to the Seattle Municipal Court and is integrated directly with the driver licensing and control programs of the Washington State Department of Motor Vehicles.

The specific objectives of the project are as follows:

1. To unburden the regular court by transferring less serious traffic infractions to a new driver adjudication/improvement system.
2. To identify and treat problem drivers at an earlier time in their driving experience.
3. To demonstrate a reduction in traffic violator recidivism, as a result of swift adjudication and

subsequent prompt referral to driver improvement programs.

4. To evaluate the cost effectiveness of the driver adjudication/improvement system to identify those elements best suited for inclusion in an expanded comprehensive statewide plan.
5. To determine those types of essential driver improvement activities which are most enhanced by the application of special adjudication/improvement processes, techniques, and sanctions.
6. To generate and evaluate local public awareness of the SAFE program and the importance of responsible driving practices, and to enhance and assess public support for overall project goals through structured public education effort.
7. To promote national interest in developing improved driver adjudication/improvement methods by demonstrating program effectiveness.
8. To ultimately reduce the number of fatal accidents caused by drivers in metropolitan Seattle.

**B. Background Information**

Each year, prior to the worldwide energy shortage, the number of persons operating motor vehicles on our public streets and highways, the total number of vehicles being operated, the average speed of the vehicles being operated, the average annual mileage per driver, and the number of available miles of public roadways continued to increase.

Concurrent with this was a continual rise in the number of people killed and injured in motor vehicle crashes. Although the state of Washington consist-

ently has been below the national average in death rate per 100 million miles and the death rate has been slowly continuing a slight downward trend, there is no denying that a state motor vehicle transportation system which killed 852 persons in 1972, which injured over 55,000 others, which permitted 100,000 traffic accidents to occur and forced the local economy to assume a loss well in excess of \$200 million could stand considerable improvement.

Coupled with the above statistics has been the growing concern among members of the judiciary, particularly the Seattle Municipal Court, of the increasing length of time that was required to obtain a court date for both traffic and criminal cases. Courts within the state of Washington operate under the "60-day rule," which means that an accused must be heard within 60 days of the defendant's appearance date. Cases which cannot be brought to trial within that time limit must of necessity be dismissed. As the court's workload continued to increase at an alarming rate, more and more cases were being dismissed because of this limitation. Imminently aware of the impending and growing problem, the presiding judge of the Municipal Court sought relief from this untenable position and proposed that a demonstration project, funded by the U.S. Department of Transportation, could provide new answers and approaches to this dilemma. At about this same time, persons within the National Highway Traffic Safety Administration were looking for suitable agencies to submit proposals for administrative or parajudicial adjudication/driver improvement systems. Partly because of the interest expressed by the court and the cooperation exhibited between the court and the Department of Motor Vehicles in the just-completed Alcohol Safety Action Project, the NHTSA accepted a proposal from the two agencies for funding consideration. Following a series of meetings and negotiations, a contract was awarded to the Department of Motor Vehicles on July 1, 1973, to commence the writing of a detailed plan.

### C. Summary of Work Accomplished

Of paramount importance in the establishment of an informal adjudication system is the removal of the criminal sanction from the so-called "minor" traffic offenses. This was ultimately accomplished in the city of Seattle, after lengthy legislative processes within the city council for the creation of an ordinance authorizing informal adjudication of minor traffic cases. Almost simultaneously, the Municipal Court

adopted new court rules, which decriminalized traffic offenses by removing the jail sanction except for the following:

1. Driving while under the influence of alcohol or drugs;
2. Reckless driving;
3. Driving while license suspended or revoked;
4. Hit and run driving, involving an attended vehicle or a pedestrian injury.

Because of the specifics of the intended research design of the project, certain other infractions were deemed to require a hearing before a magistrate for adjudication. At the outset, this included:

1. Charges arising from an accident;
2. Driving without a valid operator's license on person;
3. Speeding in excess of 15 miles an hour over the limit; or
4. A charge that is the fourth infraction in two years or the third charge in one year.

Driving without a valid operator's license on person was later dropped as a mandatory-appearance category primarily because magistrates and analysts could not justify to themselves or the defendants the need to attend a rehabilitation program based on only this one citation on their record. Substituted were:

1. Failure to yield right-of-way;
2. Following too close; and
3. Negligent driving.

Early consideration of the budget soon revealed that insufficient funds would be available to the project unless other resources were made available. For this reason, the Department of Motor Vehicles and the Municipal Court prepared an application to the Washington Traffic Safety Commission for 402 funding.\* A commitment was obtained stating that such funds would be available, not to exceed \$50,000 per annum, for the salaries and related costs of at least two magistrates and a supporting clerk. Concurrently, a proposed ordinance was prepared and submitted to the city council, which permitted the Municipal Court to accept federal funds and thus participate in the SAFE project. Individual meetings with council members by the presiding judge and project staff, in addition to testifying before the council members, resulted in affirmative action by the council with no opposition.

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\* Under the Highway Safety Act of 1966.

Integration of the proposed system into an already existing and dynamic process required a close look at the impact on the operating divisions of the court structure. Particularly impacted was the Traffic Violations Bureau, whose primary responsibility is the processing of bail notices, citations and cash flow from in-person appearances, as well as mail forfeitures. Determinations were made concerning the increased volume that the project would create for the system, and estimates were thus proposed to meet the increased data processing programming requirements. Additionally, provisions were made for increasing the memory storage capability of the data processing units, utilized by the SEA-KING data system. (SEA-KING is a shared city-county data processing system.) Currently in use by the Traffic Violations Bureau are three cash register computers, which produce a hard copy cash receipt and Magisterial Hearing Card and update the central file automatically. When the questions of volume had been resolved, it became necessary to redesign existing bail notices. It should be pointed out that the bail *amounts* were never altered for the project. Numerous new forms were also designed to accommodate and to assist in the collection of statistical data for management and evaluation purposes.

Early consideration was given to the requirements of the project for suitable quarters for analysts, magistrates, and support staff. In this particular situation, space was already at a premium; and considerable negotiating and shuffling had to be completed in order to provide a bare minimum of work area within close proximity to the other court functions. Manpower requirements were estimated as well as possible at the time and the order to commence remodeling was given early in 1974. Arrangements were made early in the planning phase to make use of office equipment which had been left over from the Alcohol Safety Action Project. Accessibility of this equipment substantially reduced the overall costs to the project by several thousands of dollars, since all the equipment was virtually new and in good condition. Transfer of the furniture from storage in Olympia to the Public Safety Building in Seattle was coordinated to coincide with the completion date of the remodeling.

The Department of Motor Vehicles Information Systems Division spent numerous hours with project personnel, assessing the needs for management information and reports for the evaluation specialists. A major component of the project was to make available the driving history of all drivers who appeared for a

hearing before a magistrate. In order to accomplish this, the record had to be translated into readable English rather than the customary coded format used for so many years by this department. Thus, a forms revision was required so that use of the high-speed video terminal and printer could be maximized. At the outset, one video terminal was thought to be adequate to recall all driver records and update the files following adjudication. It soon became apparent, however, because of the length of the format and the time involved to make the necessary entries, that an additional video needed to be installed. An operator is now kept busy full time keeping records current, while the other operator prepares the driver histories and assembles other pertinent paperwork for not only the mandatory cases, but for those who appear voluntarily for adjudication. Daily volume usually runs in the neighborhood of 100 cases.

As mentioned earlier, considerable time and detail were devoted to the process of ferreting out the procedures and policies of the Traffic Violations Bureau in order to visualize how the new project activity could be integrated with an ongoing system. Still further coordination was necessary between the project and the Evergreen Safety Council, an affiliate of the National Safety Council, so that a complete history of drivers attending Defensive Driving classes and those who were rescheduled or failed to complete was available to the evaluator. Each new procedural detail required in-depth study to determine the impact on each and every segment of the entire court system. Needless to say, it is extremely important that each step be documented so that new personnel can be apprised of their job functions and the streamlining of procedures enhanced.

As much information as could possibly be obtained concerning the project proposal, related projects in other jurisdictions, potential budget, and evaluation requirements was assembled and distributed to potential bidders for the evaluation and public information subcontracts. As a result, during the planning phase, potential bidders were invited to a formal briefing session, at which time they learned about the project and its requirements. Five potential evaluators and three public information specialists submitted proposals for consideration in late 1973. Within two weeks, the proposals had been analyzed and evaluated by the prime contractor and the NHTSA. Notification of the successful bidders was then forwarded to all persons who had submitted bids for consideration. With the

award of the subcontract for public information/education to Ballard Cannon, Inc., work immediately commenced on the preparation of informational brochures, a slide presentation, and guest appearances of project personnel on radio and television talk shows, all designed to inform the Seattle public about the goals and objectives of the project. Detailed work was initiated for the evaluation phase of the project with the Human Affairs Research Center of Battelle Memorial Institute.

Subcontract negotiations were also ongoing with the Evergreen Safety Council, which proposed to conduct not only the standard Defensive Driving Course, but a supplement, known as Programmed Learning, which is a tape-recorded version of the Defensive Driving Course and can be completed at a student's own pace. Formalized work statements for the Municipal Court, Battelle, Ballard Cannon, and the Safety Council were for the most part completed in December 1973.

The desirability of establishing an Advisory Committee soon became apparent. In an effort to solicit membership from a broad influential population, letters of invitation to serve on the committee were prepared and mailed for the signature of the Governor. Persons invited to serve included such figures as the Seattle police chief; the King County sheriff; the mayor of Seattle; the presiding judge of the Municipal Court; the director of the Department of Motor Vehicles; the president of the Women's Highway Safety Leaders; the president of the League of Women Voters; the chairman of the Citizens' Advisory Committee on Traffic Safety; the presidents of the major television stations in Seattle; editors and publishers of the daily newspapers; the director of the high school driver education system for King County; the presidents of the King County and Washington State Bar Associations; and the director of the Washington Traffic Safety Commission, who acted as chairman of the group. As with other advisory committees, the intent in this instance was to keep these top community leaders informed of the project's existence and its ongoing activities. Because of the crowded schedules of so many of the persons selected, it was decided to conduct the meetings only once per quarter. Each member was subsequently asked to designate a member of his or her staff to act as a liaison person with the project on a monthly basis, meeting together in a Coordinating Council. This latter group is known as the "working committee" and consists of those persons more intimately involved in the project's functions. They were

asked to report back to their respective superiors to keep them appraised of progress, or lack of it, on a more current basis. The value of such a committee in coordinating future plans should not be overlooked.

The project staff worked closely with the personnel office of the Department of Motor Vehicles for the establishment of the new positions necessary to conduct the project. Justifications for the existence of and duties related to the positions of clerk typist, project manager, and driver improvement analysts were prepared and submitted for approval to the Department's personnel office and, eventually, the State personnel office before hiring could commence. Since the project manager position was needed early in the program to assist with the writing of the detailed plan and other administrative chores, primary emphasis was directed toward the successful conclusion of that request. The analysts and clerk typist were not needed until a short time just before project implementation. As is common with the civil service system, several weeks elapsed between the time the positions were formally requested, approved, announcements made statewide for the availability of positions, testing, and final selection. Comparatively speaking, the selection of the magistrates to work with the project was relatively simple. Hiring of the magistrates was left to the discretion of the Municipal Court, which required a consensus of the four judges for confirmation. Magistrates must be admitted to the practice of law in the state of Washington and be current members of the State Bar Association. Prior to a change in the law, brought about during the 1975 legislative session, magistrates were also required to be residents of the city of Seattle before they could be appointed as judges pro tempore of the Municipal Court. Since one magistrate had already been employed by the city for approximately twelve months prior to implementation of the SAFE project, it was necessary only to hire two additional persons to commence operations.

Special training arrangements were made for driver improvement analysts within the Department of Motor Vehicles. Approximately two weeks were devoted to intensive "in-house" sessions, to familiarize them with all programs and options available to the Department for errant drivers of all categories. This was coupled with observation of group sessions and eventual leading of group sessions, as proficiency became apparent. At the conclusion of their training, the analysts were qualified to handle nearly any situation that would arise in the Driver Improvement Division.

Magistrates received specialized training by observation of court procedures for arraignments, trials, sentencing, etc. In addition, each magistrate spent several hours observing and riding with traffic officers to provide a perspective of the enforcement viewpoint. Technical and scientific information relating to motor vehicle crashes and their causes was distributed to all for an enlargement of the overall traffic safety problem. Insofar as possible, continuing training in court processes was arranged for by having magistrates act as judges pro tempore of the Municipal Court when short-term absences occurred.

The project staff determined that it would be highly advantageous to all concerned if a specially designed training program could be conducted for all personnel selected for the project. Thus, a training package was prepared that would expose magistrates, analysts, support clerical staff, and management staff to the interrelationships of job functions and interdependencies of each person on others within the program. The four-day training session included a lecture and demonstration series from the University of Washington's Psychology Department, input of project goals and objectives by the Department of Motor Vehicles and court staff, as well as relevant information from regional and headquarters personnel of the NHTSA. Detailed procedures were discussed, along with philosophical questions concerning the efficacy of driver improvement programs and rehabilitation efforts across the State and Nation. Small group exercises allowed each person to participate and become a member of the total group. A concerted effort was directed toward the establishment and maintenance of a special camaraderie and esprit de corps among all participants. Every effort was made to ensure that everyone recognized the importance of each other's duties and that no one person was considered to be more important or influential than another. The idea of the "team concept" was repeated many times throughout the sessions. With the conclusion of what was believed to be a very successful training program, the project staff was prepared to "go operational." Computerized mandatory-appearance bail notices were thus mailed for the first time on June 24, 1974. As can be expected, the first few weeks detected several bugs in the system; and it was not until mid-September 1974 that the project felt comfortable that the data being collected were suitable for evaluation purposes. The first-year results, then, and description of project activities

are primarily limited to that time period between mid-September 1974 and June 30, 1975.

Just described have been the major considerations for establishment and implementation of the SAFE system. Following, then, is a brief description of what actually occurs when a defendant enters this system as a result of receiving a citation for a traffic offense that is "SAFE-relevant."

1. The driver is cited by the Seattle Police for one of the previously described SAFE-relevant offenses.
2. The driver is ordered to appear for adjudication. If the driver fails to appear, a Traffic Violations Bureau warrant is issued reordering him to appear. Failure to appear to this warning generates a court bench warrant for the driver's arrest. The TVB is the body which does the preappearance paperwork to bring the defendant into the system.
3. When the defendant appears, he is assigned on a "first-come-first-served" basis to one of three magistrates. The magistrate reviews the facts of the case with the defendant and renders a disposition. This process takes place in an office-like environment. Neither police officers nor prosecutors are present. The defendant may be accompanied by his lawyer or witnesses. The magistrate reaches one of three decisions:
  - (a) Refer to court on the basis of insufficient fact to render undisputed judgment of guilt or innocence.
  - (b) Not find the defendant guilty (verdicts of not guilty, stricken, or dismissed).
  - (c) Find the defendant guilty upon admission of guilt. Guilty verdicts are followed by fines, levied in part or in toto or suspended. Jail cannot be imposed as a sanction because of the decriminalization of the traffic offenses.
4. At this point, the process of random referral by predesignation comes into play. The magistrate is instructed, by a predesignation code written on a case control sheet and magistrate card, that a guilty offender shall be referred specifically to one of the following post-adjudication actions:
  - (a) Direct sentence, without driver analyst involvement, to a driver improvement program or no-action control group.
  - (b) Counseling with a driver analyst, to be followed automatically with no analyst decision-

making, by referral to the same options as above.

- (c) Diagnostic interview with a driver improvement analyst.
- 5. There are three driver improvement analysts conducting case analyses. The analyst, following his diagnostic interview, makes one of three general decisions concerning the course of action that is best suited to the offender.
  - (a) The offender's operating license should be suspended.
  - (b) The offender is qualified for a specialized Department of Motor Vehicles rehabilitation program or sanction.
  - (c) The offender is not qualified for Department of Motor Vehicles programs.

When decision (b) or (c) is made, the specific referral made by the analyst is then guided by the predesignated assignment procedure. If the person is qualified for a DMV program, he is either sent to that program, e.g., First Group Interview, or is held out as a control comparison case without receiving the rehabilitation. Two-thirds of the cases are referred to the program, while one-third serve as controls. In this manner, control groups are comprised for each DMV rehabilitation option, excepting the set of three "other sanctions." If the person is *not* qualified for a DMV program, the analyst randomly assigns the offender to the Driver Improvement Program, Programmed Learning, or the DIP/PL control, with one-third of the eligible cases entering each group.

Predesignation means that the final adjudicative referral is predetermined (if the defendant is guilty) before the case is adjudicated. This also permits predetermination of sufficient proportions of the guilty case volume for the various experimental conditions. Predesignation is applied randomly across the guilty-case population; neither verdicts nor rehabilitation referrals are biased by this process. Its course is essentially to guarantee equivalent population from which (some) rehabilitation samples are formed, without any intervening magistrate or analyst judgments about criteria for assigning offenders to programs. The only random assignments are to DIP or PL, to DIP/PL or a no-action control, and to DMV programs versus their no-action counterparts. There are no a priori reasons to expect that participation in general driver training will harm the offender. How-

ever, if a case occurs where the adjudicator feels the predesignated referral might jeopardize the individual, he may take exception to the referral.

The remaining two-thirds of the offender population continues through the system by a process similar to that just described, but without predesignated assignments and control groups. The flow into this part of the system begins as before with a citation and appearance before a SAFE magistrate. The basic difference is that after a determination of guilt, the follow-up actions are based upon the magistrate's best judgment, rather than by random assignment. This portion of the system represents SAFE activities that would be followed after the experimental evaluation project has terminated (unless modified by results of the evaluation). The population of cases entering the next segment of the design represents two kinds of offenders: (a) those whose appearance under a SAFE-relevant citation was mandatory or (b) defendants who appear voluntarily to have their cases, which are based on moving but non-SAFE mandatory citations, heard by a magistrate. This class of defendants is called "walk-in." Since they are motivated to appear voluntarily, and since their alleged offenses differ from the set of seven SAFE offenses, walk-ins are not included for impact evaluation with mandatory cases subject to predesignated adjudication follow-up. All walk-ins are referred to rehabilitation, analyst diagnosis, or no action at the magistrate's discretion. The magistrate makes one of three decisions, based on his/her assessment of the circumstances of the case:

1. Refer directly to (usually DIP) rehabilitation;
2. Refer to a driver improvement analyst for analysis, diagnosis, and referral;
3. Take no follow-up action—send the case to a routine DMV record review, which may, at a later time, apply further sanctions or rehabilitation programs to the offender.

Following diagnosis of the cases he analyzes, the analyst makes one of three best-judgment decisions:

1. Recommend license suspension,
2. Refer to an appropriate rehabilitation program, or
3. Take no further action.

Referrals to DMV rehabilitation programs are made for offenders with specific driving problems, and no cases are held out for control comparisons.

The project's experimental/control design involves alternative modes of adjudication, with which the outcomes of informal magistrate adjudication may be

compared. Five percent of the SAFE-relevant offenses represent the traditional case-processing method of permitting the defendant to assume guilt and pay his ticket. This "forfeit" option requires only that the defendant forfeit his bond (amount of fine) and have the case closed, primarily via the mails. If, however, the defendant rejects the option and wishes to contest the citation, he may request a court date or appear at his convenience for a magistrate hearing.

The third major comparison group consists of a randomly determined 10 percent of the SAFE-offense cases, which are required to be heard in formal municipal court proceedings. These cases are adjudicated per the normal process of the courts for adjudication, disposition, and follow-up referral. Offenders may be referred to driver improvement rehabilitation through this route, as well as via magistrate hearings. Adjudication outcomes may thus be compared for SAFE versus court versus forfeit processes, with equivalent (same types of traffic offenses) populations of defendants.

The foregoing represents the basic design for assessing the effectiveness of SAFE adjudication and rehabilitation. Outcomes of the various treatments and information to which they may be related are measured in several ways. The principal data collection measures are a case data control sheet and DMV and TVB records. The control sheet provides information pertinent to case background, defendant characteristics, adjudication, DIA actions, rehabilitation referrals and case updates (rehabilitation completion, fine payment). Recidivism data are collected through the state driver records. (Details of the evaluation information management system are available in the SAFE Work Plan, August 1974.) Additional data were secured to relate to project objectives of "reducing accidents and violations," "unburdening the courts," and "implementing acceptable programs." The basic experimental/control design was supplemented with more general "before-after" comparisons of accidents and violations. To this end, monthly traffic statistics were provided by the Seattle Traffic Engineering Department. Records of caseload and dispositions in the regular municipal court were obtained through monthly court activity summaries.

#### **D. Summary of Significant Results**

##### **How SAFE is Being Evaluated**

SAFE was designed and implemented to permit rigorous evaluation of program effectiveness. The evaluation approach involves:

1. Comparison of alternative ways to handle traffic cases;
2. Random assignment to experimental treatment and control conditions where appropriate and consistent with equal justice; and
3. Measurement of impacts in multiple domains related to project goals.

The effects of the overall program and its adjudication, sanctions, and rehabilitation components are evaluated with respect to administrative efficiency and the future behavior of drivers and the attitudes of drivers and other people involved in the program.

The major criteria of program effectiveness are:

1. Efficient administration, based on processing volume and time; case dispositions and referrals and operating costs;
2. Fairness to the defendant;
3. Recidivism among defendants, including violations and accidents incurred after a SAFE appearance;
4. The attitudes of defendants toward the program; and
5. The attitudes of the general public and law enforcement and adjudication personnel.

Three case-processing alternatives are being compared:

1. SAFE,
2. Municipal court trials, and
3. Bond forfeiture (paying the ticket by mail).

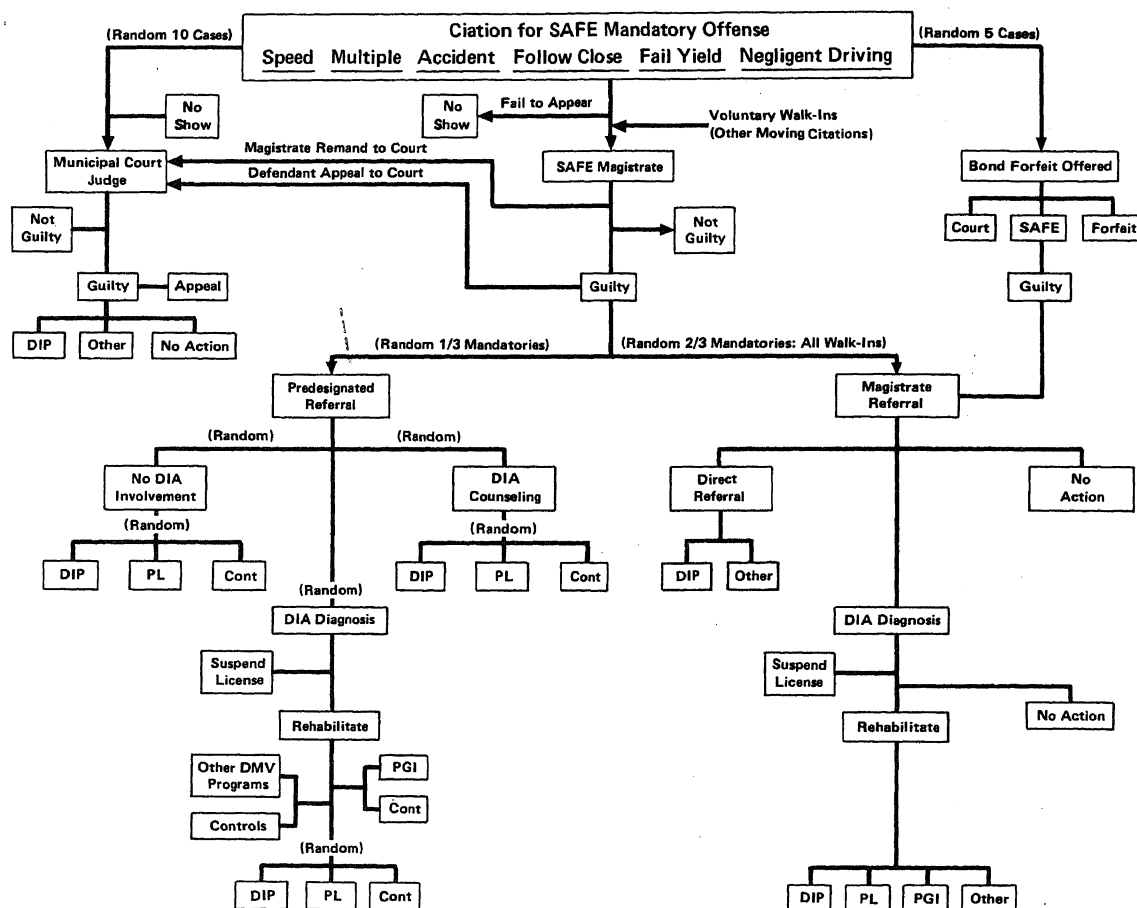
These comparisons are shown in Figure 1, which is described in detail in the complete annual report. Several features of that comparison design should be noted:

1. Within the SAFE process there are two major referral methods for offenders: (a) actions based on magistrate decisions and (b) actions based on predesignated referrals. The former involves magistrates' referrals to rehabilitation, diagnosis, or no action at their discretion. The latter involves predetermined assignments to DIA action (counseling, diagnosis, or none) and rehabilitation (or none) to which magistrates may take exception only with good cause. This procedure equalizes the populations of offenders receiving different treatments so that their effects may be examined without contaminating influences of personal characteristics, driving histories, or adjudicators' decision biases.

2. Defendants appearing mandatorily and voluntarily are differentiated. Only one-third of those cited for offenses requiring a mandatory appearance are included in the experimental versus control evaluation within SAFE.
3. Offenders may be referred to either a rehabilitation program or a no-action control group. Thus, rehabilitation effectiveness may be evaluated by comparing programs against each other and by comparing those offenders who received a particular kind of rehabilitation with those who did not. The major rehabilitation programs shown

in the figure are: (a) DIP—Driver Improvement Program—a lecture class based on the National Safety Council's Defensive Driving Course; (b) PL—Programmed Learning—a self-instruction form of the Defensive Driving Course using tape cassettes; and (c) FGI—First Group Interview—a Department of Motor Vehicles program for drivers diagnosed as over-aggressive. Offenders are randomly referred to DIP, PL, or a DIP/PL control group (see part II of the figure). One-third of those who are diagnosed to qualify for FGI are assigned to the FGI control group.

**Figure 1. SAFE Evaluation Design**





## Case Processing: Volume and Speed

During the first nine and one-half months of operation, SAFE processed 17,721 minor traffic cases, of which 69 percent involved mandatory appearances; 35 percent were speeding cases and 30 percent were multiple offenders, having three citations in one year or four in two years. The caseload averaged 96 per day or 480 per week. Most of the defendants were men (73 percent), white (82 percent), relatively young (79 percent between the ages of 18 and 34) with low-to-moderate incomes (90 percent earned less than \$15,000). Voluntary defendants included more women and people with better driving records.

It took an average of forty-six minutes to process a SAFE case, excluding any time spent in rehabilitation programs. The defendant spent about six minutes with the magistrate and eleven minutes with the DIA. The times the DIA spent, generally counseling offenders and diagnosing their driving problems, did not differ substantially. Half of the defendants had to wait less than half an hour for their hearings.

## Case Dispositions

Eighty-seven percent of the cases were judged guilty. Offenders were fined an average of \$20, of which \$10 was suspended. For offenders assigned to rehabilitation and also fined, the amounts suspended were higher. DIA's recommended driver license suspensions for less than one percent of the defendants. Over twenty percent of the defendants were referred to some form of rehabilitation; 2,721 people were assigned to the two Defensive Driving Courses, 694 were sent to First Group Interview, and 401 were referred to other DMV programs.

## Case Processing Costs

Based on current volume, it has cost \$13.10 to process a SAFE case. This conservative estimate includes only cost associated with direct defendant processing, excluding enforcement costs and some ancillary office management costs. The diagnostic-rehabilitation component of SAFE accounts for 59 percent of the administrative cost. Adding costs incurred by the defendant (fine and time) and subtracting savings due to recidivism prevention produced a net societal economic cost of \$22.67 per case.

## Changes in the Court's Efficiency

During SAFE's operation, improvements have been noted in administration of the Municipal Court. While

the trends are preliminary, and factors other than SAFE may account for some change, SAFE has demonstrated the capability to help the courts by reducing their traffic caseload. While SAFE added 2,278 cases to the court's load, through assignment for evaluation purposes and magistrate referrals to trial, it also absorbed 5,548 walk-in cases. If half of those walk-ins would have been motivated to take their cases to court in the absence of SAFE, the walk-in assistance of SAFE would more than balance its mandatory-case imposition on the courts.

The most important improvement in court efficiency has been reduction of the docket backlog. As shown in Figure 2, there was a temporary increase in the backlog early in the SAFE operational period. Since the winter peak, there has been a fairly steady decrease in the backlog. The improvement has come in the number of cases pending trial for more than a month, which has dropped to 135 (three-month aver-

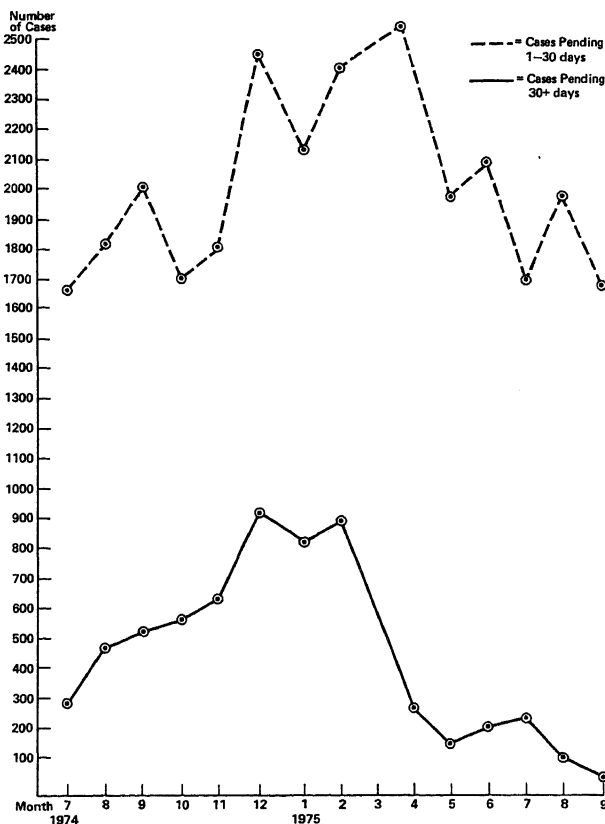


Figure 2. The Court Backlog: Number of Cases Pending by Month

nontraffic ordinance violations and in fines assessed from both traffic and ordinance violators.

### **Different People Receive Equal Judicial Treatment**

Defendants with different personal characteristics, with few exceptions, fared equally in their SAFE hearings. Only driving exposure was related to verdicts, with guilty outcomes being more common for people who reported that they typically drive fewer miles per week. Fines levied on offenders appeared superficially to vary with their sex, age, education, and income. However, the effects of such personal characteristics were minimal or nil when the influence of other factors (i.e., offense committed and driving record) were partialled out (controlled). Thus, for example, while men were fined more than women, men also tended to have had poorer driving records and to have committed more serious offenses, which carry higher fines. The only characteristic related to fines that could not be explained by other logical correlates was the defendant's education. High school graduates were fined more than people with either less or more education.

### **Different Magistrates Give Equal Judicial Treatment**

SAFE employs three magistrates. What happens to the defendant generally does not depend on which magistrate hears his case. As shown in Table 1, different magistrates spend different amounts of time with defendants and differ in their referral patterns; i.e., referrals to court and to rehabilitation. However, they have been consistent in verdict and fine dispositions. While magistrates differed significantly in their fines, the magnitude of that difference was on the order of only \$1. Furthermore, recidivism rates were equivalent for offenders who saw different magistrates.

### **Impact of the SAFE System on Driver Behavior**

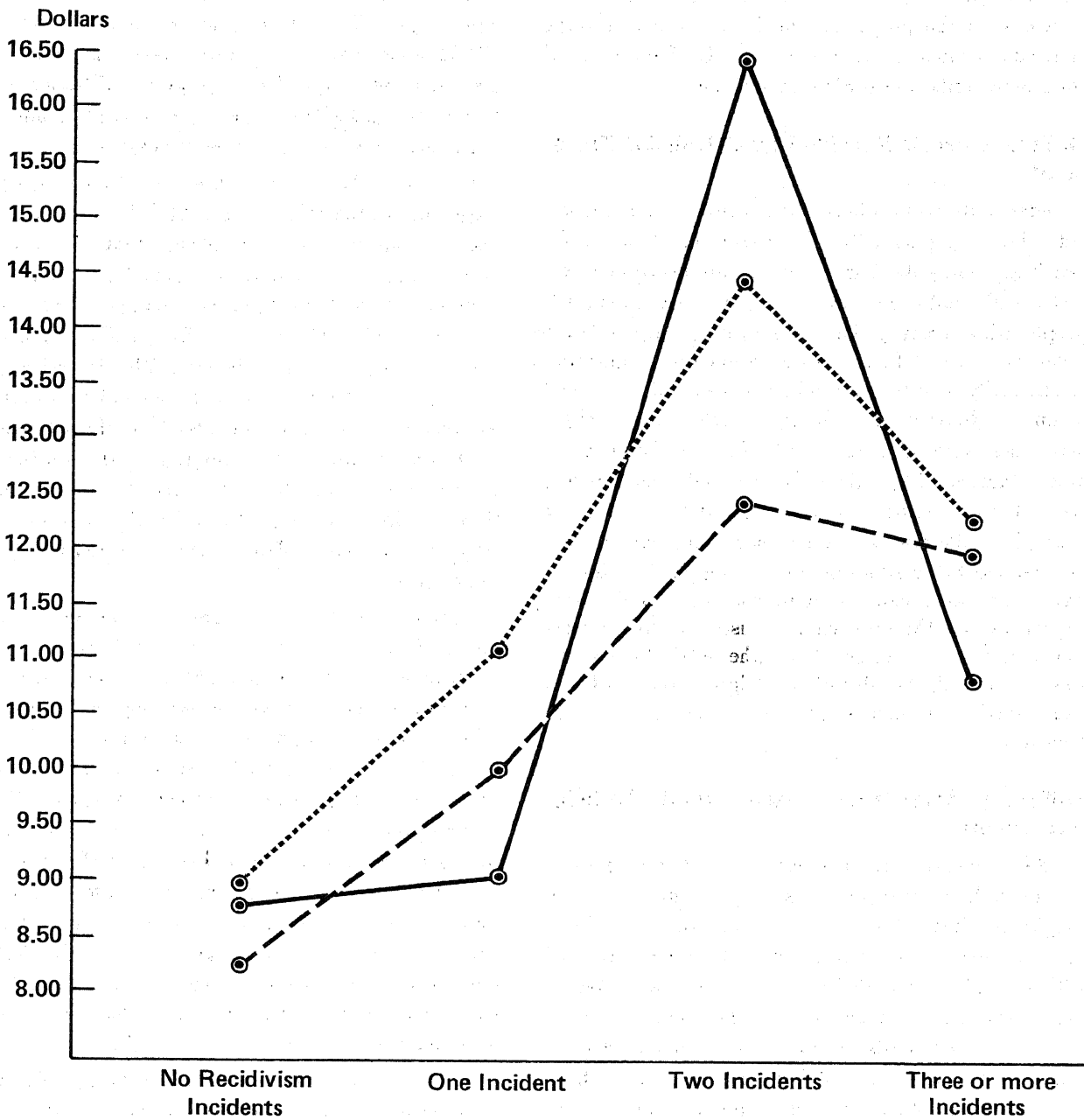
The magistrate-hearing portion of the SAFE system seems to have been largely responsible for the system's beneficial impacts on driving behavior. When de-

Informal magistrate hearings produced significantly better driving behavior (slower recidivism) than court trials or forfeiture without an appearance.

Results available at this time do not allow complete evaluation of the DIA's role in SAFE. However, they suggest that offenders' contact with DIA's has not had notable impacts on those offenders' later driving behavior. There have been no recidivism differences for offenders referred to rehabilitation (defensive driving) with, versus without, a DIA interview preceding the referral. The time to citation recidivism has tended to be longer for offenders referred directly to the driver improvement program by the magistrates' judgment than for those referred to that program through direct predesignated referral. Driver license suspension recommendations have been too few to test their impacts.

Accident and citation impacts of the SAFE, court and forfeit alternatives are shown in Table 2. Accident rates have not differed, although people who went to court tended to have an accident more quickly. SAFE, however, has been the (significantly) best approach for minimizing the occurrence of and extending the time to commission of traffic violations. Fewer SAFE (and court) defendants committed violations than did people who forfeited bond. SAFE produced the longest time to recidivism, and court yielded the shortest time. This difference in time-to-failure indicates that the mere fact of appearing for adjudication is no better than forfeiting bond. What matters is the way a mandatory-appearance case is handled: SAFE procedures were superior to court trials.

Fine sanctions have been shown to be related to recidivism. However, their effect was such that those who had been fined more severely were involved in more recidivism incidents, at least when comparing offenders with zero, one, and two incidents (see Figure 3). Analyses of fine variances showed that differences with respect to both citations and accidents were significant. Fines have clearly not had a deterrent effect on driving problems. Rather, offenders may be reciprocating for lower fines with safer driving.



Note:

- = Accidents
- ..... = SAFE Citations
- - - = Non-SAFE Citations

**Figure 3. Amount of Fine Levied on Later Recidivists and Nonrecidivists**

## **ABSTRACT CITATIONS**

# SAMPLE ENTRIES

## FORMAT OF ENTRIES IN HIGHWAY SAFETY LITERATURE

NHTSA accession number ----- HS-013 124  
Title of document ----- **MAXIMUM BRAKE PEDAL FORCES PRODUCED BY  
MALE AND FEMALE DRIVERS**  
Abstract ----- The object of this research was to obtain data concerning the  
maximum amount of brake pedal force that automobile drivers  
were able to sustain over a period of ten seconds. Subjects  
were told to apply the brakes in the test car as they would in a  
panic stop, and to exert as much force as possible on the  
pedal over the entire ten second test period. A total of 84 sub-  
jects were tested, including 42 males and 42 females. The  
results indicated that there is a wide distribution of values  
which characterizes the pedal force that the subjects were able  
to generate. Male subjects produced generally higher forces  
than did females. Over half the women tested were unable to  
exert more than 150 lbs. of force with either foot alone, but  
when both feet were applied to the pedal, force levels rose sig-  
nificantly.  
Personal author(s) ----- by C. R. VonBuseck  
Corporate author (or author's affiliation) ----- General Motors Corp.  
Publication date; pagination ----- 1973? ; 18p  
Supplementary note ----- Excerpts from Maximum Parking Brake Forces Applied by  
Male and Female Drivers (EM-23) BY R. L. Bierley, 1965, are  
included.  
Availability ----- Availability: Corporate author

NHTSA accession number ----- HS-018 924  
Title of document ----- **NATURAL FREQUENCIES OF THE BIAS TIRE**  
Abstract ----- The lowest natural frequencies of a bias tire under inflation  
pressure are deduced by assuming the bias tire as a composite  
structure of a bias-laminated, toroidal membrane shell and  
rigorously taking three displacement components into con-  
sideration. The point collocation method is used to solve a  
derived system of differential equations with variable coeffi-  
cients. It is found that the lowest natural frequencies calcu-  
lated for two kinds of bias tire agree well with the correspond-  
ing experimental results in a wide range of inflation pressures.  
Results of the approximate analysis show that the influences  
of the in-plane inertia forces on natural frequency may be con-  
sidered small, but the influences of in-plane displacements are  
large, particularly on the natural frequency of the tire under  
low inflation pressure.  
Personal author(s) ----- by Masami Hirano; Takashi Akasaka  
Journal citation ----- Publ: Tire Science and Technology v4 n2 p86-114 (May 1976)  
Publication date ----- 1976; 6refs  
Availability ----- Availability: See publication

## ECONOMICS OF MANUFACTURING AUTOMOTIVE DIESEL FUEL

To determine the possible impact on the domestic petroleum industry of diesel-powered cars and light trucks in the U.S. market, an analysis was undertaken of the economics of manufacturing greater amounts of automotive diesel fuel. It was found that with a favorable crude slate, a typical U.S. refinery could make up to 30% of total motor fuel as diesel fuel without unusual problems. The cetane quality that could be produced economically would depend on crude composition; while 45 cetane fuel probably would not be troublesome, large amounts of 50 cetane fuel would involve substantial extra costs with certain crudes. Contrary to popular opinion, switching from gasoline to diesel fuel manufacture does not yield significant saving in refinery energy consumption. Manufacture of diesel fuel rather than an equal volume of gasoline consumes more crude oil because the diesel fuel weighs more per gallon. It also requires additional investments because some refinery facilities must be expanded. For a refinery to maintain revenue, the price of diesel fuel relative to gasoline must rise significantly if diesel fuel demand grows. Refinery energy consumption declines only slightly as diesel fuel volume rises, and the reduction in itself is too small to provide any incentive for switching to diesel cars. Diesel cars must be justified on the basis of their improved fuel mileage, not because of any advantage in fuel supply.

by T. O. Wagner  
Amoco Oil Co., Res. and Devel. Dept.  
Rept. No. SAE-770758; 1977; 20p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 567

## ANOTHER LOOK AT ALTERNATIVE FUEL OPTIONS

Alternatives to petroleum-derived transportation fuels can be produced from oil shale, coal, and from a variety of carbonaceous materials including both cultivated biomass and waste materials. In the long term, hydrogen, often mentioned as an alternative fuel, may be used as an energy carrier or transfer agent; it should not, however, be considered as an energy resource. Among the alternatives, coal-derived or shale-derived fuels could become significant in the national supply within the century. The other alternatives are long-term (post-2000), or, at least without extensive resource development, they are resource-limited. Any identifiable shale-derived fuel probably will appear as conventional finished fuel, either gasoline or distillate. More likely, however, the shale-derived component of fuels will not be identifiable because any shale oil available for the manufacture of transportation fuels within the foreseeable future will be blended with natural crude and used as refinery feedstock. Coal-derived fuels may be methanol, gasoline from methanol, or conventional gasolines or distillate-type fuels either synthesized from coal or refined from coal syncrude, i.e. a "liquefied" coal. Methanol or a methanol derivative would be produced using coal gasification as the primary conversion process. The technology for coal gasification is well-established whereas that for coal liquefac-

tion is not fully-developed. For this reason, methanol or methanol-derived gasoline are the most likely alternative fuels if production of nonpetroleum fuels were to be required in the immediate future. The next step most likely would be conventional fuels from coal synthesis by the SASOL process. The evidence available to date indicates that should gasoline or distillate be made from either coal or shale oil, those fuels will not differ markedly from traditional fuels. Using coal as the primary resource, the cost of methanol or gasoline from methanol would at current estimates compare favorably with the cost of gasoline produced from natural crude costing about \$20/bbl to \$25/bbl.

by R. W. Hurn  
Energy Res. and Devel. Administration  
Rept. No. SAE-770759; 1977; 11p 12refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 568

## THE STATE HIGHWAY FINANCE OUTLOOK

The uncertainty in the financial outlook for state highway programs relates to inflation, increased noncapital costs, increased vehicle efficiency, increased fuel prices, and deteriorating highway systems. The combined effects of these factors result in fewer real dollars being spent for highway improvement. Although the future is uncertain, it is likely that highway travel will continue to increase, highway costs will escalate, and revenue growth will level off, or even decline. Reduced real capital investment, in turn, will likely reduce highway performance. While many states have voiced concern over maintaining highway capital improvement programs, several states have moved forward with some novel fiscal approaches. To achieve desired funding levels, the Washington State system indexed gasoline tax rates with budget needs and motor fuel prices. Texas, departing from the user-tax concept, sets the highway budget in real dollars by allocating supplemental general revenues to the highway fund. Another scheme, used in Kentucky, focuses the tax burden on those precipitating specific highway needs, i.e. coal producers and users. Although these examples will likely encourage other novel approaches to highway funding, the most appropriate and just method of funding highways is still the road-user charge. The traditional road-user tax concept is just and equitable in that users are taxed (via toll charges, motor fuel taxes, motor vehicle fees and permits) for particular and measurable benefits they receive for government expenditures for highways. The most appropriate method to meet the state highway programs' need for additional revenues is to raise road-user tax rates, or sensitize taxes to inflation. The highway-user tax has performed well over the years but is not likely to meet future highway needs, especially at today's tax rates. Because of the impact of the energy crisis and inflation, highway taxation is expected to move to resemble more closely a pricing system. As costs and benefits increase, so should the tax.

by Thomas W. Cooper  
Federal Hwy. Administration, Office of Prog. and Policy  
Planning, Washington, D.C. 20590  
1978; 102p 26refs  
Availability: Corporate author

HS-024 569

**HIGHWAY NEEDS TO SOLVE ENERGY PROBLEMS.  
REPORT OF THE SECRETARY OF  
TRANSPORTATION TO THE CONGRESS OF THE  
UNITED STATES IN COMPLIANCE WITH SECTION  
153 OF PUBLIC LAW 94-280, THE FEDERAL-AID  
HIGHWAY ACT OF 1976**

U.S. transportation needs relating to energy resources (particularly coal), their relation to highway needs, and revenues available to fund such needs are addressed. The question of Federal assistance for the construction or reconstruction of highways on and off the Federal-aid systems necessary for the transportation of coal or other uses is explored and various alternatives for meeting these needs both in the short and long terms are suggested. The transportation of coal by truck is, and will continue to be, a major part of the energy transportation system. Many of the roads used for coal hauling in the Appalachian states have deteriorated and are in need of repair. The projected increase in demand for coal from these areas will place new burdens on coal-haul road systems. Since the coal industry and, ultimately, coal users will derive important benefits from coal-road improvements, they should bear the cost. As a promising, potential, long-term solution to providing necessary revenues, the use of a coal severance tax is recommended in order to keep the costs within the coal sector. This would maintain a strong reliance on the "users pay" principle and would allow the price of coal to reflect more adequately all necessary production and transportation costs. The Dept. of Transportation currently is studying the feasibility and advisability of such an approach. Because the coal road and railroad grade crossings need immediate attention and cannot await enactment of legislation as to the proper type and level of tax that should be imposed in the long run, in the short term it is recommended that existing (and recently proposed) Federal programs increasingly be directed toward meeting immediate coal-road needs. These funding sources include the following Federal programs: regular Federal-aid highway program, especially for those roads on the primary and secondary systems; other highway programs which have received appropriations from Congress; the Abandoned Mine Reclamation Fund; the newly proposed Energy Impact Assistance Program; and the Appalachian Highway Funds. States and localities also should be increasing their involvement consistent with the Federal-state partnership in highway construction.

Dept. of Transportation, Office of the Secretary, Washington, D.C. 20590  
1978; 156p refs  
95th Congress, 2nd Sess., Sen. 95-126.  
Availability: GPO

HS-024 570

**ANTI-FREEZE. OR...PREPARING YOUR CAR--AND  
YOURSELF--FOR WINTER**

Hints on preparing the driver and his automobile for the winter season and tips on winter driving are presented. Car preparations include tuning engine, changing the oil, checking the battery, adding antifreeze, checking windshield washer solution supply and windshield wipers, checking headlights and taillights, testing the heater and defroster, looking for leaks in the exhaust system (particularly rusty spots), examining the brake linings/pads, and selecting suitable snow tires or

deciding on tire chains. A list, by state and province, of the restrictions on the use of studded tires in the U.S. and Canada is included. Additional driver preparations include having the right supplies in the car for any emergency (assorted screwdrivers, an adjustable wrench, pliers, electrical tape, medium-gauge wire, spare bulbs and fuses, a couple of cans of oil, some brake fluid, a container of coolant, power steering/automatic transmission fluids, first-aid kit, road flares or reflectors, spare wiper blades, windshield washer solution, extra fanbelt, road maps, flashlight with extra batteries, and jumper cables), and cold-weather supplies (ice scraper with a brush, small shovel, small quantity of sand or salt, tow rope or chain, and some gas-line antifreeze). Tips on eliminating icing problems include prevention alternatives (keeping car in garage or carport, covering car with a tarpaulin or car cover, and covering the windows) and de-icing steps (starting car, running defroster, brushing off all snow, and scraping off all the windows). Tips for driving on snowy or icy roads include the following: be more cautious (allow more time for everything); apply lightest pressure on gas pedal to get car rolling; speed up gradually; anticipate moves (e.g. slow down before getting to turn); allow more space between vehicle in front; if involved in skid, slow down and steer into the direction of the skid; and if wheels are spinning, try rocking the car until wheels catch on something solid.

Publ: Driver v12 n5 p1, 3-9 (Oct 1978)  
1978; 2refs  
Availability: See publication

HS-024 571

**1977 ACCIDENTS OF MOTOR CARRIERS OF  
PASSENGERS [U.S.]**

Tables and graphs of statistical data are presented relating to fatalities, injuries, property damage, regional variations, and type of accident, compiled from 830 accident reports filed with the Bureau of Motor Carrier Safety by motor carriers of passengers operating in interstate or foreign commerce during 1977. Reports are filed for accidents resulting in death, injuries which involved medical treatment away from the scene of the accident, or property damage of \$2000 or more. The reported accidents for 1977 resulted in 87 deaths, 1929 injuries, and \$3.6 million in property damage. Six bus accidents resulted in nine passenger fatalities, five accidents occurring during adverse weather conditions. The accidents included 51 pedestrian accidents, involving 14 fatalities and 37 injured persons. Information is presented in the following sections: summary (basic facts on intercity bus industry, statistics by trip classification, and accident statistics, accident rates, and mileage for Class I carriers by geographic region); highway environment (light condition, weather condition, road surface condition, number of lanes and type of highway, and expressway ramp); time and place (time of accident, time of day and day of week, hours driving and time of day, monthly statistics, hours driving and type of district, and statistics by state), the driver (driver age, driver's years of service with company, driver age, experience, and type operation, and collision/noncollision accidents by driver age and type operation and experience with company); the vehicle (year of manufacture, type of vehicle, mechanical defects, and seat belt information); and the accident itself (movement of reporting vehicle, collision object, collision by hours driving, noncollision by hours driving, and collision/noncollision involving fire).

Bureau of Motor Carrier Safety, Washington, D.C. 20590  
1978; 63p  
Availability: GPO

HS-024 572

**VOLUNTARY HELMET USE [MOTORCYCLISTS]**

The reputation of safety helmets as effective life-saving devices was damaged by Congress' 1976 decision to withdraw authority from the Dept. of Transportation (DOT) to withhold funds from a state which failed to require helmet use by motorcyclists 18 years of age or older. Helmets will not prevent all head injuries in accidents, but they will provide a three times better chance of surviving an accident. Available evidence does not support the claim that helmets increase neck injuries or cause accidents by impairing hearing or vision. The Motorcycle Safety Foundation (MSF), the Motorcycle Industry Council (MIC), and the American Motorcyclist Assoc. (AMA) agree with DOT on these points even though the AMA opposes helmet laws, and the MSF and MIC take no position either for or against such laws. Many riders have been misled by the arguments voiced in opposition to helmet laws into believing that helmets are not worthwhile safety devices. The increase in motorcycle fatalities in states which repealed their helmet laws was more than twice the increase in the states which retain helmet laws. Government, the industry, rider groups, and the motorcycling press have a special obligation to correct the misconceptions about helmets and to encourage voluntary helmet use. Motorcycle manufacturers could play a key role by providing organizations such as AMA and MSF with adequate funds to develop effective education programs promoting voluntary helmet use, by devoting more ad space to the need for and effectiveness of helmets, and by providing new buyers with helmet information. Dealers also could provide incentives to buy and use helmets. In states where helmet laws have been repealed, lobbying groups such as AMA could encourage development and implementation of public information and education programs promoting voluntary helmet use. At the Federal level, work has begun to develop educational materials to encourage voluntary use; other motorcycle projects include field testing of improved knowledge and skill tests, field testing of an improved in-traffic skill test, and developing a training program for advanced riders. Motorcycle helmet use should be only one part of a comprehensive motorcycle safety program; other elements should include driver licensing, rider education, conspicuity and public information and education.

by Charles F. Livingston  
National Hwy. Traffic Safety Administration, Traffic Safety Programs, Washington, D.C. 20590  
Publ: Road Rider v9 n9 p56-7 (Sep 1978)  
1978

At head of title: Guest Shot.  
Availability: See publication

HS-024 573

**CONSUMER PROBLEMS WITH AUTO REPAIR**

In this consumer fact sheet, some ways are explored to help reduce the estimated \$20 billion wasted annually on poor, needless, or fraudulent auto repairs and maintenance. The Federal government's growing recognition that a coordinated approach to consumer auto repair problems is needed was reflected in agency views expressed during Mar 1978 Congressional hearings. Typical provisions of state auto repair regulations which define deceptive practices and call for correction of shoddy repair work are outlined; these provisions relate to written estimates, return of replaced parts, invoices, mechanic's lien, posted notices, and deceptive practices and

prohibited acts. Cited is a case of an individual who exercised his rights under Michigan's Motor Vehicle Service and Repair Act in which an auto repair shop was incriminated and fined. A summary table of state auto repair activity indicates the status of disclosure, mechanic certification, and dealer registration/licensing regulations. Industry programs to make the auto repair process more consumer-responsive, generally voluntary in nature, are described, including the National Inst. for Automotive Service Excellence, the Certified Automotive Repairmen's Society, and the Automotive Consumer Action Panels. The American Automobile Assoc.'s Approved Auto Repair Prog., which identifies shops which provide quality repair in selected regions, is described, as is the Washington (D.C.) Center for the Study of Consumer Services. Tips for choosing a repair facility, what to do after a repair facility has been selected, and what to do in case of a complaint, are outlined. The advantages (greater safety, lower pollution, improved gas mileage, and lower repair and maintenance costs) of diagnostic motor vehicle inspections, annual or semi-annual physical checkups for cars, are outlined from a National Hwy. Traffic Safety Administration report based on pilot diagnostic projects. The operation of the St. Louis Diagnostic Car Clinic operated since 1967 by the Auto Club of Missouri, is described. The Automobile Owners Action Council, organized in Washington, D.C. in 1973 to assist members with specific auto repair problems (sometimes testifying on their behalf at legislative hearings), is mentioned. Automobile publications available from the Consumer Information Center are listed.

Department of Transportation, Div. of Consumer Affairs,  
Washington, D.C. 20590  
1978; 8p 15refs

Consumer Fact Sheet. Major portion of fact sheet originally published in Transpo Topics for Consumers (Apr 1978), a Dept. of Transportation newsletter.  
Availability: Corporate author

HS-024 574

**STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. INTERIM REPORT, PHASE 3. REPORT 3-1, VEHICULAR PLATOON PARAMETERS; A METHODOLOGY FOR TRAFFIC CONTROL**

The principal urban freeway problem is congestion usually caused by an excess demand on the freeway facilities; the Baltimore Harbor Tunnel Thruway is a restricted facility due to the tunnel section where the demand often exceeds the capacity. As a result, long vehicular platoons tend to form. A pretimed control system with several control alternatives, directed to alleviate congestion at the Baltimore Harbor Tunnel, was initiated in Phase 2 of this three-phase project to study traffic flow on a restricted facility utilizing the Baltimore Harbor Tunnel for field study. In the present phase, a technique was developed utilizing vehicular platoon parameters for the evaluation of the several control alternatives. Data collected at the Tunnel were used to identify platoons of two or more vehicles utilizing a 200-ft (60.9-m) minimum space headway criterion. The data also were used to determine the number and size of the platoons, the platoon concentrations, the platoon velocities, the average space headway within the platoons, and the number of vehicles within the platoons. These parameters were used as the basis of the evaluation technique. Five different control alternatives were evaluated consisting of four different cycle lengths, ranging from 2 to 4 minutes, of a traffic signal located upstream of the Tunnel entrance, and a fifth alternative where the traffic signal was not



used (no-control operation). Utilizing Greenberg's model of hydrodynamic traffic flow, the platoon concentration and platoon velocity relationship was examined for all the control alternatives. From this relationship, an optimal control policy was developed utilizing the no-control, 120-second, and 160-second alternatives. An application to on-line computer control was proposed. Appended are summaries of Phases 1 and 2 of the project.

by Jose L. Rodriguez; Roy C. Loutzenheiser  
University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742  
AW-76-116-46  
Rept. No. FHWA-MD-R-77-6; PB-282 512; TSC-0018; 1976; 69p 20refs  
Sponsored by Maryland State Hwy. Administration in cooperation with Federal Hwy. Administration. Rept. for 1975-76. See also HS-024 575.  
Availability: NTIS

HS-024 575

# **STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. INTERIM REPORT, PHASE 3. REPORT 3-2, A METHODOLOGY TO MEASURE THE INFLUENCE OF TRUCKS ON THE FLOW OF TRAFFIC**

As a means of describing the effect of trucks on the peak-period traffic flow rate, the parameters of time headway and velocity were investigated as part of a three-phase project to study traffic flow on a restricted facility utilizing the Baltimore Harbor Tunnel for field study. The time headway parameter is used to depict the manner in which passenger cars and trucks follow each other, for a given velocity. In a single lane of traffic, four relationships between successive vehicles were identified: a passenger car following a passenger car, a passenger car following a truck, a truck following a passenger car, and a truck following a truck. By analyzing and comparing the headway for vehicles represented by the four relationships, a factor, Truck Influence Ratio (TIR), was developed which expresses the number of passenger cars displaced by a truck. The factor was expanded to give an estimation of the percentage reduction in the flow rate due to the presence of trucks in the traffic lane. Analysis of the data collected on the level and upgrade sections of the Baltimore Harbor Tunnel showed that a truck displaces 1.5 passenger cars during periods of heavy traffic demand, i.e. TIR equals 1.5 passenger cars per truck. With the existing traffic volume conditions, the TIR illustrates that a 7% reduction in the flow rate is the result of the existence of trucks in the traffic stream. Appended are summaries of Phases 1 and 2 of the project, and supplementary data.

by Wayne Berman; Roy C. Loutzenheiser  
University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742  
AW-76-116-46  
Rept. No. FHWA-MD-R-77-7; PB-282 513; TSC-0019; 1976; 105p 21refs  
Sponsored by Maryland State Hwy. Administration in cooperation with Federal Hwy. Administration. Rept. for 1973-74. See also HS-024 574.  
Availability: NTIS

HS-024 576

# **MOPED SAFETY--THE FUSING OF REGULATION, EDUCATION AND ENFORCEMENT**

California presently is attempting to clarify the confusing mixture of laws which apply to mopeds and moped equipment requirements. The state classifies mopeds as motor vehicles, and legislation is pending which would require their registration. Registration is the only means of recording vehicle ownership in a consistent fashion, and the only logical mechanism for assuring any chance of recovery after theft (in California, the recovery rate has been less than 20%). Registration may even be a positive marketing tool and also offer a reminder that an operator must be licensed (a safety advantage). Another bill now before the legislature will insert a clear definition of moped equipment requirements into California law. Most such equipment presently is mandated by Federal standards, and the intent of placing it in California law is simply to collect the information in one easy-to-find location. The legislation also will specify, however, that a moped must be equipped with a mirror and an adequate muffler, that no passenger can be carried except on a securely-fastened seat behind the driver, and that the passenger must have footrests. The California Hwy. Patrol will continue to emphasize the potentially hazardous handling characteristics created by carrying a passenger, as one facet of its broad educational campaign to acquaint moped operators with safe operating techniques. The dealer can provide an important service by assuring that equipment requirements are fulfilled. Assuring safe operation of the moped must include publicizing the precautions and the safeguards traditionally recommended for the motorized operator.

by W. F. Oliver  
Publ: Journal of Traffic Safety Education v25 n4 p36-7 (Jul 1978)  
1978  
Excerpted from a presentation at 1st National Moped Conference, Anaheim, Calif., 11 May 1978.  
Availability: See publication

HS-024 577

# **DESIGN FOR A CHEVETTE SEAT BELT USAGE/DEFEAT SURVEY. FINAL REPORT**

A study was undertaken to design a survey plan for determining customer evaluation and usage of the automatic seat belt system introduced as an option on the Chevrolet Chevette in Jul 1978, with particular emphasis on the extent to which purchasers decide to disconnect the ignition interlock system and how much drivers make use of the non-automatic lap belt. After reviewing a number of data collection alternatives, it is recommended that the survey use a multi-wave mail data collection method, that the project be 18 months in duration, and begin in Jan 1979. During this period, monthly samples of Chevette purchasers would be sent mail-back questionnaires about six months after purchase. By the use of a reminder postcard and two follow-up mailings, it is anticipated that at least an 80% return could be realized. The questionnaire would be in two parts, a short part for owners on reasons for purchasing the automatic belt system and on operational conditions of the interlock system, and a longer part for principal drivers on current seat belt use and attitudes. Within this basic design framework, three alternative designs representing different levels of effort and cost are offered. The basic design would involve an effective sample of 1000 passive Chevettes

(those with an automatic seat belt system) and a minimum level of questionnaire content; it would cost about \$16,000. The intermediate design would involve an effective sample of 1200 passive Chevettes and 800 active Chevettes (those with a standard non-automatic belt system) and an expanded level of questionnaire content; it would cost about \$29,400. The full-scale design would involve an effective sample of 2000 passive Chevettes and 1000 active Chevettes, and it would have considerably more questionnaire content in the attitudinal area; it would cost about \$43,600. Also recommended is that a subsample of 100 passive Chevette purchasers be interviewed at home in place of 100 mail questionnaire respondents. This would permit the interviewer to physically check the operating condition of the seat belt interlock for validation purposes; this supplementary plan would cost about \$7500, to be used with either the intermediate or full-scale design. A more cost-effective means to obtain a larger number of validation cases might be for Chevrolet dealers to hand out questionnaires and physically check the seat belt system in passive Chevettes.

by Arthur C. Wolfe; Kenneth L. Campbell; James O'Day  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48109  
Rept. No. UM-HSRI-78-40; 1978; 47p 18refs  
Rept. for 15 May-15 Sep 1978. Sponsored by General Motors  
Corp.  
Availability: Corporate author

HS-024 578

### ENGINE KNOCK: A GROWING PROBLEM

There is general agreement in the refining industry that engine knock problems will worsen as the auto industry attempts to achieve the government's future fuel economy standards, and that the octane requirements of present, late-model cars will increase as they accumulate mileage. The National Petroleum Refiners Assoc. started a campaign in Mar 1978 to bring out the fact that refiners generally will be unable to boost the octane of their unleaded gas in the near future. Moreover, the Coordinating Res. Council (CRC), a petroleum industry research firm, has projected that more than 40% of late-model cars are not satisfied by the average octane unleaded gasoline, 92 Research octane, and the result is engine knock. CRC maintains that the number of vehicles knocking has doubled since 1972. Oil company representatives questioned by the American Automobile Assoc. were in general agreement that the automakers recently had reset engine specifications, boosting octane needs in the process, to meet the Federal government's fuel economy standards. The Environmental Protection Agency (EPA) in particular, the oil company spokesmen said, has permitted automakers to modify and certify their new cars using a "premium" unleaded testing gasoline, generally unavailable to car owners, and then to make critical, fuel-robbing engine adjustment to mollify new car owners who complain subsequently about knock. EPA says it is attempting to make its certification testing more realistic by certifying cars with the lower octane unleaded gasoline generally available to the public. However, any lowering of the test fuel octane might cause an auto company to fail to meet Federal fuel economy standards. General Motors finds engine knock acceptable, indicating that it is the "sound of fuel economy" because it indicates that engines are operating at their peak efficiency. Ford, on the other hand, believes that some types of engine knock are harmful to engines and that car owners who hear engine knock should take their cars to a reputable repair shop to be checked. Meanwhile, oil refiners have been dropping the octane levels of their premium leaded gasolines,

a trend expected to continue for two to five years as demand for the fuel drops. Octane is being lowered because only 7% to 8% of cars now use premium leaded, because EPA is demanding less lead in gasoline, and because of the increased need for refining components to meet the growing unleaded gas market. The future of high-octane fuel hinges on what EPA decides to do with MMT (methylcyclopentadienyl manganese tricarbonyl), a manganese octane booster, said to be harmful to automotive emission control systems. Governmental policies are forcing the auto and oil industries to work at cross purposes. New car octane needs are increasing at the same time that octane-boosting lead is being phased out of gasoline. EPA wants the oil industry to invest in refinery improvements to produce higher octane gasoline without raising price. The Dept. of Energy is ready to ask Congress to remove price controls from gasoline. EPA's response to the auto industry is not clear, and at this time EPA has no response to consumer complaints about knock.

by Bill Berman  
Publ: American Motorist v48 n2 p4-5 (Jul-Aug 1978)  
1978  
Availability: See publication

HS-024 579

### UTILIZATION OF WASTE HEAT IN TRUCKS FOR INCREASED FUEL ECONOMY. FINAL REPORT

An evaluation and comparison of improvement in fuel economy for a broad spectrum of truck engines and waste-heat utilization concepts are presented. The engines considered are the diesel, spark ignition (SI), gas turbine, and Stirling; principal emphasis is placed on the four-stroke diesel. The still-to-be-developed adiabatic diesel also is examined. The waste-heat utilization concepts include preheating, regeneration, turbocharging, turbocompounding, and Rankine-engine compounding. Predictions are based on fuel-air cycle analyses, computer simulation, and engine test data. All options are evaluated in terms of maximum theoretical improvement, but the diesel and adiabatic diesel also are compared on the basis of maximum expected improvement and expected improvement over a driving cycle. It is indicated that diesels should be turbocharged and aftercooled to the maximum possible level. At higher boost pressures, the engine power and the fuel economy can be increased, and leaning out the fuel-air mixture or aftercooling the compressor outlet air will reduce the nitrogen oxides. Turbocharging also increases the potential for turbocompounding if compressor and turbine efficiencies can be maintained. Diesel driving cycle performance can be increased by 20% through increased turbocharging, turbocompounding, and Rankine-engine compounding. Rankine-engine compounding provides about three times as much improvement as turbocompounding but also costs about three times as much. Performance for either approximately can be doubled if applied to an adiabatic diesel. Gas turbine performance can be improved substantially through Rankine-engine compounding, but because of a lack of energy in the exhaust, only minimal improvement is possible for the Stirling. Except for regeneration, approximately the same improvement is possible for the SI engine as for the diesel. Because of higher exhaust tem-

## HS-024 580

peratures, it would be more efficient to regenerate an SI engine.

by C. J. Leising; G. P. Purohit; S. P. DeGrey; J. G. Finegold  
National Aeronautics and Space Administration; California  
Inst. of Tech., Jet Propulsion Lab., Pasadena, Calif.  
DOE-EX-76-A-31-1011  
Rept. No. HCP/M1011-02; 1978; 38p 5refs  
Availability: GPO, stock no. 061-000-00111-5

## HS-024 580

**TUNING DOWN AUTO AIR POLLUTION**

The proper maintenance of automobiles so that they retain throughout their life their pollution-control capability is discussed. Automotive pollutants (photochemical oxidants, carbon monoxide) and their health hazards are outlined. The Environmental Protection Agency's (EPA) monitoring of the auto manufacturers' performance in meeting Federal emission standards at three stages (prototype, production, and in use) is described. Emphasis is placed on the fact that the best designed, best made emission control systems may give poor performance if damaged or improperly adjusted. A number of surveys made since 1974 indicate that practically all cars which are not checked and maintained systematically, develop serious emission problems. In this light, anticipated problems and solutions regarding the implementation of a mandatory inspection/maintenance (I/M) program for all motor vehicles are discussed. I/M programs cost money; whenever a car fails to meet emission requirements (and most will sooner or later), its owner has to pay for adjustments or repairs. However, there is substantial evidence that adjustment costs often are balanced by fuel savings because I/M-maintained cars run more efficiently and use less gasoline. A car that goes through an I/M program each year may have a longer span of usefulness and need fewer repairs. Each community will have to decide whether its air pollution situation can best be handled through a voluntary or mandatory I/M program. Since I/M not only reduces emissions substantially but offers significant fuel savings as well, it may well be the most desirable transportation pollutant control strategy.

Environmental Protection Agency, Office of Public Awareness, Washington, D.C. 20460  
Rept. No. EPA-OPA-103/8; 1978; 16p  
Availability: GPO, stock no. 055-000-00171-5

## HS-024 581

**MAINTENANCE AND HIGHWAY SAFETY HANDBOOK. 1977 UPDATE OF 1970 EDITION**

This pocket handbook presents illustrations and narrative examples of roadway hazards and scenes of good and bad highway maintenance operations. It is intended as a reference guide for maintenance crews to interest them in watching for roadway hazards; reporting hazardous highway conditions to their superiors; preventing accidents caused by improper highway maintenance; and using proper safety equipment, signs, lights, flagmen, and other safety devices to protect maintenance workers and the motoring public traveling through maintenance projects. Information and photographs are presented in the following sections: roadway pavements, roadway elements (shoulders, road approaches, median crossings and curbs), drainage, roadsides (trees and brush, mowing, trash and debris), structures (bridges), guardrails and

guideposts, traffic services (road signs, pavement markings, snow and ice control, and protection of personnel.

Highway Users Federation for Safety and Mobility, 1776 Massachusetts Ave., N.W., Washington, D.C. 20036  
Rept. No. FHWA-TS-77-223; 1977; 72p  
Prepared under the auspices of Federal Hwy. Administration.  
Availability: Federal Hwy. Administration, Offices of Res. and Devel., Washington, D.C. 20590

## HS-024 583

**A MODEL AND AN ALGORITHM FOR THE DYNAMIC TRAFFIC ASSIGNMENT PROBLEMS**

With the objective of providing a macro-model for minimizing total cost in dynamic traffic assignment, a discrete-time model was developed. The model is a nonlinear and nonconvex mathematical programming problem, and treats congestion explicitly in the flow equations. It has the capability of handling multiple origins and general topology, but is limited to one destination. In a macro-sense, the one destination situation may be reasonable for the morning home-to-work rush period. A piecewise linear version of the model, with additional assumptions on the objective function, can be solved for a global optimum using a one-pass simplex algorithm; branch-and-bound is not required. The piecewise linear program has a staircase structure and can be solved by decomposition techniques or compactification methods for sparse matrices.

by Deepak K. Merchant; George L. Nemhauser  
Publ: Transportation Science v12 n3 p183-99 (Aug 1978)  
1978; 22refs

Presented at International Symposium on Traffic Equilibrium Methods, Montreal, Nov 1974. Some results based on D. K. Merchant's doctoral dissertation, Cornell Univ., which was sponsored in part by a grant from Univ. of Rochester. G. L. Nemhauser's work sponsored in part by NSF-ENG75-00568 and by Univ. of Louvain (Belgium). See also HS-024 584.  
Availability: See publication

## HS-024 584

**OPTIMALITY CONDITIONS FOR A DYNAMIC TRAFFIC ASSIGNMENT MODEL**

A dynamic traffic assignment model formulated as a nonlinear and nonconvex mathematical program is considered. Necessary optimality conditions require equalization of certain marginal costs for all the paths that are being used, and these optimality conditions are shown to be a generalization of the optimality conditions of a conventional static traffic assignment problem. The behavior of the dynamic model under static demand conditions is examined also, and it is shown that in this case the model is a generalized version of a standard static model. The model suggests a promising refinement of the objective function for the static case.

by Deepak K. Merchant; George L. Nemhauser  
Publ: Transportation Science v12 n3 p200-7 (Aug 1978)  
1978; 3refs

Some results based on D. K. Merchant's doctoral dissertation, Cornell Univ., which was sponsored in part by a grant from Univ. of Rochester. G. L. Nemhauser's work sponsored in part by NSF-ENG75-00568 and by Univ. of Louvain (Belgium). See also HS-024 583.  
Availability: See publication

HS-024 585

### THE EFFECT OF SMALL CARS ON THE CAPACITY OF SIGNALIZED URBAN INTERSECTIONS

A study was undertaken to determine whether the size of vehicles in a traffic stream passing through a signalized urban intersection has an effect on capacity (capacity defined as the intersection's maximum throughput independent of delays, number of stops, or level of service provided to the motorist). Time headways between vehicles being discharged from a queue at a signalized urban intersection is a measure of the capacity; an event recorder actuated by tape switches on the road surface was used to measure headways at various signalized intersections in Toronto (Canada). It was found that vehicle size has an effect on headways during saturation flow. The shortest headways were found when the preceding and following cars were both small. The differences in headways between small and full-sized cars became insignificant as the traffic stream approached free-flow conditions. The difference in headways was most significant for the early vehicles in a discharging queue. Small cars had significantly shorter average headways than full-sized cars for up to at least the fifth vehicle in the line. At a signalized urban intersection, a stream of small cars can realize an increase in traffic flow over a stream of full-sized cars in the range of 10% to 15%. The amount of the increases is dependent on the length of the effective green time in each cycle. The effect of small cars on intersection capacity is greater when a number of turning movements are made.

by Gerald N. Stuart

Publ: Transportation Science v12 n3 p250-63 (Aug 1978)

1978; 14refs

Availability: See publication

HS-024 586

### SEMINAR/WORKSHOP ON PLANNING, DESIGN AND IMPLEMENTATION OF BICYCLES AND PEDESTRIAN FACILITIES PROCEEDINGS. JULY 6-8, 1977, PALO ALTO, CALIFORNIA

A compilation of papers on the subject of bicycle and pedestrian facilities is presented under headings which include potential for walking and biking in today's society, bicycle safety, the CALTRANS bicycle program, forecasting use, transit facility design, education of bicyclists, new concepts for the city center, case studies, campus planning and operations, transportation system management, bicycle user characteristics, multi-use facility design, design of pedestrian facilities for the handicapped, citizen participation, selective bicycle subjects, pedestrian systems planning and design, system evaluation, pedestrian safety, recreational biking, and plan implementation. Lists of problems and their solutions stemming from two round-table discussions (police-bicyclists cooperation and problems, bikeway design) are presented, as well as resolutions adopted at the seminar. General resolutions requested the Dept. of Transportation to study existing data and report on bicyclist experience on freeways, and on the relative safety of that experience, and to perform further research; proposed that "Bike Route" signs be given route names or numbers, and state direction traveled; proposed that a named or numbered alternative for nonmotorized traffic be provided, if not already allowed, on named or numbered highways; and proposed that, in a 1980 census, the word

"bicycle" be included as a specific response choice of mode of travel to work.

by Wolfgang S. Homburger, ed.

Metropolitan Assoc. of Urban Designers and Environmental Planners

Rept. No. UCB-ITS-P-78-1; 1978; 535p refs

Availability: University of California, Inst. of Transportation Studies, Berkeley, Calif.

HS-024 587

### EXPERIMENTAL RESULTS USING METHANOL AND METHANOL/GASOLINE BLENDS AS AUTOMOTIVE ENGINE FUEL

An experimental program was conducted to determine the emission and fuel-economy characteristics of methanol and methanol/gasoline blends as automotive fuel. Comparative emission and fuel energy economy data were generated using 1975-model vehicles adjusted for gasoline fuel and using gasoline and gasoline blended with 5% and 10% methanol; tests were made at temperatures of 20 degrees F, 75 degrees F, and 100 degrees F on a chassis dynamometer in a climate-controlled test chamber. Results suggest that emissions and fuel energy economy generally are affected to the extent that methanol addition affects air-fuel stoichiometry, fuel heat content, and fuel vapor pressure. The term "fuel energy economy" is used to denote calculations on the basis of fuel energy content in lieu of fuel quantity. Vehicle emissions and fuel economy essentially were unchanged during approximately 7500 miles of road testing; no engine or fuel system component failures were encountered. Road octane measurements were made for fuels containing 5%, 10%, and 15% methanol in base gasolines of 84, 87, and 91 Research octane quality. Results show significantly better octane improvement in blending methanol with the lower octane fuels. Steady-state engine emission and fuel energy economy data were generated using a late-model automotive engine fueled with 5%, 10%, 15%, and 100% methanol/gasoline blend. Test variables and engine parametric adjustments included engine speed, exhaust gas recirculation rate, air-fuel ratio, ignition timing, and compression ratio. Results suggest that operation with pure methanol may allow use of high-compression engines to realize improved fuel economy with relatively low nitrogen oxides emission.

by J. R. Allsup

Bartlesville Energy Res. Center, Bartlesville, Okla.

Rept. No. BERC-RI-76-15; 1977; 88p 6refs

Availability: NTIS

HS-024 588

### DRINKING-AND-DRIVING IN SCANDINAVIA

Nine articles on the subject of drinking/driving in the Scandinavian countries are presented, either for Scandinavia as a whole, or for the individual countries of Denmark, Finland, Norway, and Sweden. Topics covered include the legal framework; the effects of drinking/driving laws; effectiveness of these laws; the biochemistry, law and morality of drinking-and-driving; and topics on drunken driving: a tentative causal model; deterrence in Norway and Sweden: an econometric analysis of existing policies; drunken driving in Sweden;

politics of drunken driving in Sweden; and research on drunken driving in Scandinavia.

by Ragnar Hauge, ed.  
1978; 145p refs  
Vol. 6 of "Scandinavian Studies in Criminology." Includes HS-024 589--HS-024 597. Published under the auspices of Scandinavian Res. Council for Criminology.  
Availability: Columbia University Press, 562 W. 113th St., New York, N.Y. 10025

HS-024 589

### **DRINKING-AND-DRIVING IN SCANDINAVIA--THE LEGAL FRAMEWORK**

The evolution of drinking/driving legislation in the individual Scandinavian countries is traced (Denmark, Finland, Norway and Sweden). Each country's experiences are treated separately by different authors. Denmark's legislative history includes the early days of motoring, drunken drivers, penalties inflicted in the 1920's, a stronger line since 1932, critical views, and a new course from 1976. Finland's experience includes sections on the 1926 Motor Vehicle Traffic Act, the 1937 reform, a new increase in penalties in 1950, the Road Traffic Act and the punishment practice (1957), the turning point (1967-1968), and the reform of the legal provisions relating to drunken driving (1971-1976). Norway's legislative history includes sections on the first drinking-and-driving laws, clinical examination and blood alcohol test, and loopholes in the law. Sweden's drinking/driving legislation contains the following sections: alcohol, revocation of driving license, and traffic offenses; penalties for drunken driving; introduction of blood test; reduction of the pro mille limit (expressed in milligrams of alcohol per 100 mille liters of blood); and the Act of 1974. The number of persons convicted of offenses against drinking-and-driving laws per year in Finland, Norway, and Sweden and persons prosecuted in Denmark for the years 1935 through 1975 are tabulated. Also given are the population, number of private cars per 1000 inhabitants, and consumption of alcoholic beverages in liters per inhabitant over 14 years of age in 1973 for the individual countries. The main steps in the development of drinking/driving legislation in each country are outlined by year in tabular form.

by Knud Waaben; Hannu Takala; Ragnar Hauge; Ake Ihrfelt  
Publ: HS-024 588, "Drinking-and-Driving in Scandinavia," Oslo, 1978 p1-33  
1978; 29refs  
Availability: In HS-024 588

HS-024 590

### **THE EFFECTS OF SCANDINAVIA'S DRINKING-AND-DRIVING LAWS: FACTS AND HYPOTHESES**

Using Norway as the prototype Scandinavian country in introducing definite blood alcohol limits and strict penalties for drinking/driving, an evaluation is made of this drinking/driving legislation, which has gained an international reputation for stringency and supposed effectiveness. In 1936 it was made a criminal offense in Norway to drive a motor vehicle if one had more than 0.5 pro mille of alcohol in the blood (i.e. 50 mg of alcohol/100 ml of blood). At the same time the normal penalty for a drunken driving offense was set at imprisonment for at least 21 days. The driver's license was also to be suspended permanently for a repeated offense. This legislation has

remained in force practically without change since that time. To all appearances the stringent legislation in Norway imposing a definite and low limit for the permitted blood alcohol concentration (BAC) has succeeded in making the great majority of motorists aware of the severe penal provisions, and of the danger and culpability of driving a motor vehicle after having consumed alcohol in excess of the legal limit. There is also no doubt that a great many people deliberately adapt their conduct to meet the law's demands by abstaining from drinking in connection with driving or by limiting themselves to a very modest consumption. Little is known about how far the law's motivating effect extends to different social groups, and it is natural to think that the law's effect is greatest among groups least likely to be drinking/driving offenders. Little definite knowledge is known about the role of alcohol in traffic accidents in Norway compared with other countries, and about the effect of legislation and penalties. Recent research has questioned earlier studies indicating that the number of alcohol-induced accidents in the country was very small. More research is needed.

by Johannes Andenaes  
Publ: HS-024 588, "Drinking-and-Driving in Scandinavia," Oslo, 1978 p35-53  
1978; 21refs  
Availability: In HS-024 588

HS-024 591

### **SCANDINAVIA'S DRINKING-AND-DRIVING LAWS: DO THEY WORK?**

A search was made for all available evidence concerning the deterrent effectiveness of the Norwegian and Swedish drinking-and-driving laws, and statistical data on traffic accidents were reviewed using interrupted time-series analysis in an attempt to verify the claims made for the legislation's deterrent success. It was concluded that the impression of deterrent effectiveness for these laws rests on an informal and unscientific base. There is no scientifically available evidence supporting the legislation's deterrent effect nor, a fortiori, can the contributions of the various components (blood alcohol concentration limits, penalties) of the legislation be scientifically appraised. Change and experimentation in these laws should be encouraged in order to establish their effectiveness, if possible, and to understand their effect on driver behavior. Further research is needed, and political action, based on the assumption that the present drinking-and-driving laws are effective, is inadvisable, since deterrence may be accomplished at too high a cost of individual freedom.

by H. Laurence Ross  
Publ: HS-024 588, "Drinking-and-Driving in Scandinavia," Oslo, 1978 p55-60  
1978; 17refs  
Availability: In HS-024 588

HS-024 592

### **DRINKING-AND-DRIVING: BIOCHEMISTRY, LAW AND MORALITY**

An investigation was made of 1590 persons living in Norway to determine their knowledge of and attitudes toward drunken driving in order to examine the impact of the country's drinking-and-driving legislation on a representative sample of the population. According to Norwegian law, it is criminal for a

driver to operate a motor vehicle while he has a blood alcohol content (BAC) of 0.5 pro mille (50 mg alcohol/100 ml blood) or more. On the basis of interviews with the sample population, it appears that knowledge of the drunken driving legislation is relatively widespread in Norway. In spite of the fact that the legislation is associated with biochemical concepts and processes (i.e. intake and absorption of alcohol in the body) about which the individual has no way of acquiring knowledge through everyday experience, information on the biochemistry of alcohol, wherever it may have been obtained, has been apparently well disseminated. Practically everyone questioned knew where the pro mille limit is drawn and what criminal sanctions may be imposed. There were also many who knew approximately how much one can drink of various alcohol beverages in order to reach this limit, and many who had a comparatively good understanding of the absorption rate of alcohol. An overwhelming majority of those who knew the correct pro mille limit were of the opinion that this was the appropriate limit or that it ought to be lower; among those who did not know the correct limit, there were a great many who were in favor of the actual limit or one that was lower. In many ways the data seem to indicate that the 0.5 pro mille level not only has been accepted by the population but has become a part of the moral atmosphere. This limit is regarded as the dividing line between responsible and irresponsible driving, and the point at which it is right to draw the distinction between what is criminal and what is not. The result of a biochemical analysis not only has been established by legislation as the criterion of criminality, but it also has been adopted by the populace as the criterion that decides the essential morality of the act.

by Ragnar Hauge  
 Publ: HS-024 588, "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p61-8  
 1978  
 Availability: In HS-024 588

HS-024 593

### **DRUNKEN DRIVING: A TENTATIVE CAUSAL MODEL**

A tentative causal model for drunken driving is presented based on the responses of 1541 licensed drivers in Sweden to a questionnaire. The requested data were used to analyze the relationship of demographic variables to the probability of drunken driving. The various causative factors in drunken driving were elicited from answers to the various questions posed to the sample population: age and sex, marital status, alcohol consumption, mileage, perception of risks (getting involved in a traffic accident, detection by police), knowledge about drinking/driving legislation, morality of legislation, and frequency of drunken driving. The model derived depicts that the askew distribution of the demographic variables of those who have been drinking and driving can be explained by the fact that men, young people, and unmarried persons scored differently from their counterparts on variables which contribute directly or indirectly to drunken driving. Alcohol consumption and mileage were determined to be the most crucial factors contributing to drunken driving, although the impact of the latter factor is hidden in interactive effects. Implications for countermeasures include the apparent need to reduce the total number of situations in which people may be prone to drink and drive, such as alcohol and traffic policy aimed at reducing the use of alcohol as well as of cars. This type of policy, however, is politically awkward, being incompatible

with public opinion and with economic structure. Less controversial although presumably less efficient measures include increased enforcement and more intensive information campaigns.

by Thor Norstrom  
 Publ: HS-024 588 "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p69-78  
 1978; 8refs  
 Sponsored by National Swedish Council for Crime Prevention,  
 and Swedish Road Safety Office.  
 Availability: In HS-024 588

HS-024 594

### **THE DETERRENCE OF DRUNKEN DRIVING IN NORWAY AND SWEDEN: AN ECONOMETRIC ANALYSIS OF EXISTING POLICIES**

Using time-series data for Norway from 1954 to 1973 and data representing a cross section by county for Sweden for 1972, alternative evaluations were made of the general hypothesis that drunken driving is controllable, i.e. that additional resources devoted to enforcement will deter drunken driving and thus reduce accident levels. It is indicated that apparent ambiguities in the data which measure drinking, driving, and law enforcement activities can be sorted out with the use of models that specifically account for the interrelationships among the data sources. Fundamental theories of deterrence are supported by the data, once the simultaneity of relationships is specified. The results, while based on limited data, appear to indicate that Scandinavians respond to law enforcement. By implication, their performance with respect to drinking and not driving while under the influence of alcohol is, in large measure, strongly reinforced by legal sanctions. The Swedish data also suggest that it is law enforcement rather than control of beverage sales that has the greater influence on accident reduction, although this is not supported by the Norwegian data. Such policy questions as the cost effectiveness of law enforcement to regulate drunken driving need to be examined, including social costs and benefits of alternative sanctions. The present research suggests that cost effectiveness studies are feasible if more complete data can be provided.

by Harold L. Votey, Jr.  
 Publ: HS-024 588, "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p79-99  
 1978; 26refs  
 Based on a presentation at Western Economic Assoc. Annual Meeting, San Francisco, Jun 1976. Research sponsored by Ford Foundation, and National Inst. of Mental Health.  
 Availability: In HS-024 588

HS-024 595

### **ACTUAL DRUNKEN DRIVING IN SWEDEN**

During Mar-Apr 1975 in five different geographical areas in Sweden, a sample of 9125 drivers was taken at random with regard to time, place, and vehicle, for a breathalyzer test administered by roadside police patrols. Police were empowered by a time-limited law effective 1 Jan 1975 to test drivers routinely without reasonable suspicion of drunken driving. If the breathalyzer indicated a blood alcohol content in excess of the 0.5 pro mille (50 mg alcohol/100 ml blood) legal limit, or if the driver refused to take the test, a blood test was taken. The objective of this routine testing was to furnish practical experience for more extensive projects of this kind, and was in-

tended to provide information about the true proportion and structure of drunken driving in Sweden. The possibilities of generalizing from the sample studied are limited in that the sample was relatively small and certain times and areas were not included; the proportion of driving-while-intoxicated drivers revealed by this study cannot be used as a direct measure of actual drunken driving in the country. It was found that 22 persons exceeded the 0.5 pro mille limit, and 38 persons showed the influence of alcohol, but not above 0.5 pro mille. This proportion of detected drinking drivers (2.4 per thousand) is considered 200 times lower than the actual number of drinking/driving offenders.

by Leif G. W. Persson  
 Publ: HS-024 588, "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p101-12  
 1978; 6refs  
 Availability: In HS-024 588

## HS-024 596

### ON THE POLITICS OF DRUNKEN DRIVING IN SWEDEN

The basis of the punishment ideology for drunken driving in Sweden today stems from the introduction in 1934 of unconditional imprisonment for driving-while-intoxicated cases, the legislation having been motivated by a concern to prevent drunken driving. In 1934, the introduction of blood tests as evidence of intoxication was also introduced. In 1941, the legal limit of 0.8 pro mille (80 mg alcohol/100 ml blood) was set. With the exceptions of a legal recognition of other drugs as equal to alcohol in driving impairment (1951), a change in the pro mille limit to 0.5 (1957), and a legal recognition of criminal liability if pro mille limit has been exceeded after the act of driving (1975), there have been no changes in the Swedish drinking-and-driving legislation in spite of many attempts during three decades. In spite of long prevailing uncertainty about the effectiveness of different legal regulations there has been a lack of serious investigations based on social science theory and empirical evidence necessary to consider the need for reform. Instead of proposing reforms, the government has established new committees. In 1970, the last governmental committee proposed probation with supervision and treatment of alcohol problems as a sanction instead of unconditional imprisonment for most drunken drivers. This proposal was rejected by about one-third of the agencies reviewing it. The government still has not put any proposal regarding sanctions before the Parliament, mainly for fear of creating too much social conflict and group conflict both in Swedish society as a whole and in Parliament. The question of drunken driving has always been one of the most divisive questions in Parliament, between and within parties. The pressure on government from Parliament and its Com. on Justice has been and still is very strongly in favor of reform, and it now seems that government has decided to introduce reforms, but very slowly. The temporary routine breath tests and evaluation of that experimental period have led to permanent legislation in 1976 which included driver's license suspension. The next step probably will be to introduce some reform regarding sanctions, depending on the reactions to a proposal by a government committee on the payment of fines. It is apparent that, due to the low rate of

detection of drunken driving, the legal sanctions are in a sense symbolic, tending to minimize political controversy.

by Hans Klette  
 Publ: HS-024 588, "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p113-9  
 1978; 4refs  
 Availability: In HS-024 588

## HS-024 597

### RESEARCH ON DRUNKEN DRIVING IN SCANDINAVIA

A review of research results on various aspects of drunk driving is presented individually for Denmark, Finland, Norway, and Sweden, each country treated by one author. Denmark's research is analyzed separately for studies relating to alcohol consumption and traffic accidents, the question of hidden drunken driving ("dark figure"), convicted drunk drivers (background, drinking habits, etc.), assessment of the type of intoxication (alcohol and different types of drugs), and public attitudes toward drunken driving. Research in Finland includes drunken driving and blood alcohol content, drunk drivers (background, drinking habits, etc.), sentencing practice, growth of drunken driving offenses, other aspects (public attitudes about drunken driving and its punishment, ban on sale of alcohol and drunken driving offenses). For Norway, a review is presented of research on alcohol consumption and traffic accidents, hidden drunken driving, risk of detection of drunken drivers (socioeconomic status, recidivism), and public attitudes toward drunken driving. Research in Sweden has centered on alcohol consumption and traffic accidents, hidden drunken driving, risk of detection, drunken driver characteristics, public attitudes toward drunken driving, and time-series studies of drunken driving offenses. For each country except Denmark, the types of official statistics compiled for traffic accidents are outlined.

by Gitte Carstensen; Hannu Takala; Ragnar Hauge; Hanns Van Hofer  
 Publ: HS-024 588, "Drinking-and-Driving in Scandinavia,"  
 Oslo, 1978 p121-40  
 1978; 122refs  
 Availability: In HS-024 588

## HS-024 598

### WHY WE NEED AIR BAGS

General information is presented on air cushion restraint systems (or air bags) for automatic crash protection of automobile passengers, in an effort to promote a better understanding of their operation and their vital role in traffic safety. Air bags or passive (automatic) belt systems will be mandatory on all new cars in the U.S. beginning with the 1985 model year. It is expected that 9000 fatalities and 65,000 moderate to serious injuries in automobile crashes can be prevented annually by the use of passive restraint systems. Air bags have been proven to cushion impact and prevent injury in frontal and front-angle crashes, the number one highway killer, more effectively than lap and shoulder harnesses. It is estimated that when mass produced, air cushion systems need not add more than \$112 to the price of a new car. Information presented in support of air bags includes the following: photographs of car impact tests showing the crash effects on a dummy driver protected by an air bag vs. an unrestrained

Washington State senator who provided him by an air bag when he was involved in a two-car collision; statistics on fatalities in car crashes in 1976 according to seating position of passengers, showing that most fatalities involve front-seat occupants; and accounts of the effectiveness of air bags when tested using stunt drivers in actual vehicle-barrier crashes. Drawings of the air bag passive restraint system and a description of its operation are provided. Passive belt systems are described as well. A preference for air bags vs automatic seat belts by police officers and other auto fleet operators is cited. Some questions and answers typically asked by the public about passive restraints are presented. Topics concerning air bags include cost, replacement after activation, deterioration with age, accidental inflation, and failure to inflate. Other questions involve suitability of present seat belts, and mandatory wearing of seat belts as an alternative to air bags.

by Paul Snodgrass

National Hwy. Traffic Safety Administration, Region 9, Two Embarcadero Center, Suite 610, San Francisco, Calif. 94111

Publ: California Highway Patrolman v42 n9 p6-10, 34-5, 37-9, 41, 43-6, 48 (Nov 1978)

1978; 5refs

Availability: See publication

HS-024 599

## THE AGE OF THE SEALED BATTERY

The introduction of new technologies such as the high-energy sodium-sulfur battery and advanced primary batteries with light weight and long life is stimulating a series of important innovations in the original lead-acid battery. One of these is the sealed lead-acid battery which contains "gas-recombining" electrodes. Developed over the last ten years and now available in a limited range of sizes, the battery offers the following advantages: elimination of noxious gases or corrosive vapors, no requirement for water addition or terminal cleaning, resistance to overcharging and extensive discharge cycling. This battery can be operated in any position and without leakage even if the container is damaged; it is very resistant to vibration, and can be recharged by constant-current or constant-potential methods. At present, usage is confined to standby applications, such as emergency lighting and alarm systems, and to portable equipment such as television, lanterns, and garden tools. Other applications to be considered for this battery are those which are sensitive to the evolution of oxygen and hydrogen and corrosive vapors. These include many "uninterrupted power supply" duties such as those required for computers, and for batteries used in mines, submarines, or aircraft. Probably the greatest impact on the consumer public would be achieved by the adoption of sealed batteries for automotive applications. The lack of gas evolution, the total elimination of maintenance and resistance to vibration associated with this battery eliminates battery location constraints in automobile design.

by Ken Peters

Publ: Engineering v218 n10 p1020-2 (Oct 1978)

1978; 5refs

Availability: See publication

## REHABILITATION ENGINEERING FOR THE HANDICAPPED

The seven million handicapped persons in the U.S. with chronic limitations in basic life activities such as hearing, speaking, seeing, performing manual tasks, walking, learning, or working are being helped today through rehabilitation engineering, which offers considerable hope for restoring mobility and self-sufficiency to the disabled. The previous haphazard approach to helping the handicapped changed with the formation of medical-engineering teams at the Univ. of California (Berkeley and Los Angeles) and the coordination of Veterans Administration (VA) programs through the National Acad. of Sciences (NAS). The results of these programs were made available through formal education programs given by medical schools at UCLA, New York Univ., and Northwestern Univ. Meanwhile, forerunners of the Dept. of Health, Education, and Welfare's (HEW) Rehabilitation Services Administration (RSA) assumed responsibility for meeting needs of the civilian disabled. By the 1970's, HEW personnel coined the term "rehabilitation engineering" and NAS formulated a plan to conduct research, development, evaluation, and education to improve the quality of life of the physically handicapped through a total approach to rehabilitation, combining medicine, engineering, and related sciences. Rehabilitation engineering has since become a recognized field of specialization within the province of biomedical engineering. Since the Rehabilitation Act of 1973, the RSA and VA have established centers of rehabilitation engineering where engineers and doctors can join forces in a coordinated, nationwide program for using technology to aid the handicapped. RSA missions are sensory aides for blind and deaf, functional electrical stimulation of paralyzed nerves and muscles, vocational aspects of rehabilitation, effects of pressure on tissue, low back pain, mobility systems for severely disabled, internal total joint replacement, automotive transportation for the handicapped, electrical stimulation for upper extremity function, spinal cord injury, locomotion and mobility, evaluation of functional performances of devices for the severely disabled, neuromuscular control using sensory feedback systems, and communications systems for individuals with nonvocal disabilities. The most generally recognized area for increased effectiveness is in mobility. The ultimate challenge is to develop artificial limbs that duplicate the complex neurophysiological interaction between mind and muscle, within the constraints of size, weight and appearance.

by Mark D. Zimmerman

Publ: Machine Design v50 n25 p24-6, 28-9 (Nov 1978)

1978

Availability: See publication

HS-024 601

## PROGRESS IN POWDER METALLURGY

Powder metallurgy (PM) technology continues to progress, both with new materials and improved processing methods. An important trend in PM processing has been toward fully dense parts with improved properties. Density can be increased with the use of larger compacting presses, double pressing (coining), isostatic pressing, and hot forging. Some current activity is in hot-isostatic pressing (HIP), a method for compacting materials in an autoclave, using high temperature and pressure. Cold compacting of titanium powders to near-net-shape preforms by a new proprietary process promises to bring this



high-performance metal into a more attainable price range. Split-die compacting removes an important limitation of conventional compacting methods, the need to draw the compacted parts from the die in one direction. This method, also called the "double-die process", produces parts with projections and offsets that could not be ejected from traditional die systems. Forging of sintered powdered preforms is the most active area of PM technology today. Like isostatic pressing, powder forging produces 100% dense parts, but the faster forging rate is better suited for high-volume production. To overcome the limitations in compressibility of powders when prealloyed materials are atomized, a line of Distaloy powders recently has been produced by a proprietary process wherein fine powdered alloying elements such as nickel, copper, and molybdenum are diffusion-bonded to the surface of the atomized iron-powder particles. Much of the alloying occurs during sintering, and the high-compressibility characteristic of the basic powder is retained. Materials progress has been achieved in aluminum and titanium PM technologies. PM brings the following advantages to tool steels for improving their structure and homogeneity: smaller grain size, easier grindability, higher strength (due to absence of carbide banding), less distortion during heat treatment, and potential for more complex alloys. The largest consumer of metal-powder parts is the automobile industry. Today, a full-size U.S. passenger car contains up to 17 lb of PM components; by 1980, the total is expected to reach 28 lb per car.

by Donald R. Dreger

Publ: Machine Design v50 n25 p116-21 (9 Nov 1978)  
1978

Availability: See publication

HS-024 602

### SYNCHRONOUS BELTS FOR HIGH-POWER DRIVES

Once limited to low-power drives, synchronous belts, with the use of nonstretch tensile cords and a more efficient tooth profile, are now making inroads in high-power drives once restricted to V-belts, chains, and gears. In these applications, synchronous belts offer high operating efficiency and low maintenance and reduced operating costs, savings which often offset their generally higher initial cost. The selection of synchronous belts for high-power drives requires close attention to system requirements. While V-belts readily can absorb a 10% to 20% overload, synchronous belts are less tolerant of load fluctuations and shocks. Underestimating load requirements can result in sheared teeth or broken belts. Alignment also must be controlled carefully because any twisting concentrates the load on only a few tensile cords and interferes with belt tracking. Synchronous belts have either trapezoidal or curved teeth, the former being the standard type. Trapezoidal-tooth belts are rated for loads from subfractional to over 150 hp and for speeds over 16,000 rpm; standard pitches are 0.080 in, 0.200 in, 0.375 in, 0.500 in, 0.875 in, and 1.25 in. Curved-tooth belts, also called HTD belts, have deeper, rounded teeth that allow higher torque capacity for a given belt tensile strength. Depending on drive conditions, these belts carry from 120% to 200% higher hp than trapezoidal-tooth belts. HTD belts handle loads and speeds commonly associated with chain drives, i.e. up to 275 hp at speeds from 10 rpm to 5500 rpm; standard pitches are 8 mm and 14 mm. Both types of belts operate at speed ratios as high as 9:1; efficiency ratings for both average about 98%. In general, synchronous belts are alternatives to V-belts and roller chains where high efficiency is required, where maintenance is difficult and in harsh en-

vironments. Synchronous belts also solve the problem of vibration; exposure to high and low temperatures, of static electricity; and fixed center distance or limited-amplitude drives. They should not be used where the drive is inherently misaligned, when slip is required, and in clutch mechanisms.

by J. J. Zaiss

Publ: Machine Design v50 n25 p122-5 (9 Nov 1978)  
1978

Availability: See publication

HS-024 603

### MAN-TRACTOR SYSTEM DYNAMICS: TOWARD BETTER SUSPENSION SYSTEM FOR HUMAN RIDE COMFORT

Tractor drivers suffer from a number of disorders of the head and supporting structures at low-frequency and high-amplitude vibrations that are encountered in their field activities. In regard, the occupant-tractor system is modeled as a lumped parameter system. The composite model is analyzed by computer simulation to determine the suitability of two types of suspension (relaxation-type seat suspension, relaxation suspensions for both the seat and the front axle) for isolation of both vertical and rotational (pitch) vibrations. These responses are compared to responses for rigid seat and front and standard front-axle suspensions, as determined by previous investigators. Based on responses of the composite man-tractor model to ground reaction simulating steady sinusoidal vibrations, it is concluded that the relaxation type of suspension either to the seat or to both the seat and the front axle of the tractor is better than the standard type of suspension provided to the front axle of the tractor. The man's body parts in a tractor with the relaxation suspension provided to both the seat and the front axle have a lower maximum vertical vibrational response (amplitude 2.37) vs. responses of the body parts (amplitude ratio 2.4) in a tractor fitted with a relaxation type of seat suspension. At low frequencies, pitch responses are lower for a relaxation suspension tractor vs. a relaxation seat and front axle suspension tractor. At higher frequencies, a relaxation seat and front axle suspension tractor is better than a relaxation seat suspension tractor, since the former is more effective in attenuating the pitch vibrations of the body. By considering both the ride and vibration isolation characteristics, it is recommended that tractors be provided with a relaxation type of seat suspension only.

by M. K. Patil; M. S. Palanichamy; D. N. Ghista

Publ: Journal of Biomechanics v11 n819 p397-406 (1978)  
1978; 14 refs

Availability: See publication

HS-024 604

### HANDBOOK FOR THE ACCIDENT RECONSTRUCTIONIST. REVISED ED.

The scientific techniques needed for the reconstruction of traffic accidents and the specific areas where these techniques apply are consolidated in this manual to be used for reference purposes by police personnel. Chapters deal with the following areas of mathematics and physics: remedial mathematics; geometric construction; derivation of minimum speed from the drag factor formula, and the distance formula (see

derivation of fall speed formulae; derivation of the vault formula; derivation of the critical speed formula; derivation of the kinetic energy equation for a skidding vehicle and the combined speed equation; derivation of the radius equation and the tangent offset equations; a hypothetical accident situation designed to show the application of a quadratic equation; applications of time-distance equations; an equation that shows the relationship between size of an image on a negative and the true size of the object being photographed (perspective grid photography); the Law of Conservation of Energy of Momentum and how it can be used to determine the speeds of vehicles at impact; and special problems that must be considered when speed from skidmarks is calculated for a vehicle that has no brakes or inoperative brakes on some of its wheels (weight shift equation). An appendix provides sample problems and exercises to solve and perform using the information provided, along with answers to these problems.

by M. J. Lofgren  
Minnesota State Patrol  
1977; 221p  
Availability: Princeton Publishing, 509 1st St., Princeton,  
Minn. 55371

HS-024 605

**TRANSPORTATION AND THE URBAN ENVIRONMENT. THE RATIONAL RELATIONSHIP BETWEEN AUTOMOBILE AND PUBLIC TRANSIT DEVELOPMENT. A JOINT REPORT OF THE U.S./U.S.S.R. URBAN TRANSPORTATION TEAM UNDER THE "AGREEMENT ON COOPERATION IN THE FIELD OF ENVIRONMENTAL PROTECTION"**

Results of four meetings (two in the U.S., two in the U.S.S.R.) between U.S. and Soviet members of the Urban Transportation and Environment Proj., held to view directly the transportation-environmental interaction in urban areas of the two countries, to exchange information, and to discuss themes of interest to both countries, are presented in two parts (U.S. team report, U.S.S.R. team report) and in a set of joint conclusions. Chapters discuss the relationship between transportation and land use, transportation and the environment, modal split and ridesharing (U.S.) and distribution of passenger conveyance between public transportation and passenger automobiles (U.S.S.R.), mass transit characteristics, restrictions on automobile use (U.S.) and measures to increase the effectiveness of mass public transportation (U.S.S.R.), and the rational relationship between public and private transportation in urban areas. It is concluded that urban transportation system planning, i.e. streets, roads, buses, private vehicles and rapid transit, is an integral part of urban planning. Coordinated program development on the Federal, state, regional and local levels is necessary in the U.S.; in the U.S.S.R., on the Union, Republic and urban levels. Transportation system selection is affected by zoning, population density, cost and time of journey, density of work areas, and initial construction costs. At present, the distribution between public and automobile transport is different in the U.S. and the U.S.S.R. In the U.S., over 90% of all trips are made by car, while in the U.S.S.R., over 90% use public transport. The private automobile provides comfort, mobility, and rapid transportation at the control of the user. Transportation systems that rely almost exclusively on automobile use have led to adverse effects on the environment, excessive energy consumption, and traffic congestion. Environmental protection laws in both countries require that the effect of an urban transportation system on the environ-

ment be determined prior to development, when this effect will be significant. Experience has indicated that it is possible in some situations to induce more passengers to make work trips by public transport. Improvement of public transportation in terms of speed and comfort is essential (exclusive bus lanes, express bus service, ride sharing). Specific solutions for the U.S. and the U.S.S.R. may vary. Disincentives or limitations on private car use may help improve the urban environment (e.g. parking restrictions and increase in gasoline cost). Specialists agree that balance is essential between public and private transport, with consideration being given to the environment, mobility, energy efficiency, convenience and time savings. This balance will require sound government policy, careful planning and coordination, and effective implementation.

by Salvatore Bellomo; Joel Segal; Martin Convisser; Kendall Wilson; Michael Lash; Barbara Schilberg; Raymond Weil; Yu. A. Stavnychiy; D. C. Krivosheev; M. I. Kagan; N. A. Ryabikov; R. V. Gorbanev  
Department of Transportation, Washington, D.C. 20590;  
Central Scientific Res. and Design Inst. on Urban Devel. (Gosgrazhdanstroy), Moscow, U.S.S.R.  
1978; 181p 76refs  
Availability: GPO, stock no. 050-000-00141-5

HS-024 606

**STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. FINAL PROJECT REPORT**

The accomplishments are summarized of a three-phase project initiated in 1971 to study traffic flow on a restricted facility, utilizing the Baltimore Harbor Tunnel for field study. The research project was designed to test the capability for applying traffic flow theory concepts to the actual operation of highway facilities, particularly restricted facilities. During the first phase of the project, the problems were defined, the critical sections (and the bottleneck) were identified, and the flow parameters were measured. The parameters of volume, speed, density, headways, and vehicle lengths by lane were calculated. The second phase was to have included analyses of several control alternatives; however, due to various problems, the efforts were concentrated on evaluation of a Markov model. Actual control was by a pretimed traffic signal located between the toll booth and the entrance to the Tunnel, and one set of cycle lengths was tested. The third phase was concerned with further evaluation of control strategies, concepts for data acquisition in the southbound tube of the Tunnel, and network analysis. Limited data show that a mainline control signal upstream of the Tunnel entrance can operate at a fixed rate and increase throughput while increasing average speed. Further analysis of the Tunnel traffic flow characteristics should produce methods to optimize flow through the Tunnel. A real-time data acquisition system using inductive loops is necessary in the Tunnel and along the throughway. A minicomputer located at the Tunnel should be used to analyze the data and develop an overall control-system hierarchy. Such control probably would include input ramp control, mainline

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control, and variable-message signs. Traffic flow theory can be applied to improve operations on restricted facilities.

by Everett C. Carter; Roy C. Loutzenheiser  
University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742  
AW-76-116-46  
Rept. No. FHWA-MD-R-77-9; TSC-0021; PB-282 515; 1977; 41p 11refs  
Rept. for 1971-1976. Sponsored by Maryland State Highway Administration.  
Availability: NTIS

HS-024 607

# **CERAMIC REGENERATOR SYSTEMS DEVELOPMENT PROGRAM. PROGRESS REPORT, OCT. 1, 1976 TO SEPT. 30, 1977**

A task-by-task description is presented of the work accomplished from 1 Oct 1976 to 30 Sep 1977 on the DOE (Dept. of Energy)/NASA (National Aeronautics and Space Administration) Ceramic Regenerator Design and Reliability Prog. The primary objective of the program is to develop ceramic regenerator cores for passenger car gas turbine engines, Stirling engines, and industrial/truck gas turbine engines. The major cause of failure of early gas turbine regenerators was found to be chemical attack on the ceramic material. Improved materials and design concepts aimed at reducing or eliminating chemical attack were tested for durability in Ford 707 industrial gas turbine engines late in 1974. The results of 19,600 hr of turbine engine durability testing are described. Two materials, aluminum silicate and magnesium aluminum silicate, continue to show promise toward achieving the durability objectives of the program. A regenerator core made from aluminum silicate shows minimal evidence of chemical attack damage after 6935 hr of engine test at 800 degrees C (1472 degrees F), and another shows little distress after 3510 hr at 982 degrees C (1800 degrees F). Technical progress made during this period includes ceramic material screening tests, aerothermodynamic performance tests, design studies of advanced regenerator systems, ceramic thermal stability tests, manufacturing cost studies, stress analysis, and core material and design specifications.

by J. A. Cook; C. A. Fucinari; J. N. Lingscheit; C. J. Rahnke  
Ford Motor Co., Res. Staff, Dearborn, Mich. 48121  
DEN-3-8  
Rept. No. NASA-CR-135330; DOE-CONS/0008-1; N78-25988; 1977; 130p 6refs  
Prepared under Interagency Agreement EC-77-A-31-1040 for National Aeronautics and Space Administration.  
Availability: NTIS

HS-024 608

# **TCI FOR DIESELS. A PILOT STUDY OF THE APPLICATION OF TURBULENCE CONTROLLED INDUCTION TO A DIRECT-INJECTION DIESEL ENGINE**

A preliminary study was made to determine whether a TCI (turbulence controlled induction) design could be produced to match the results achieved by the port shelf turbulence generator which it replaced in an open-chamber diesel engine. Test results show that the TCI engine, in fact, had improved performance over that of the standard engine. The results should be considered as strong evidence that further substantial im-

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provements will result from optimization of the engine TCI design parameters. The TCI design tested had relatively minor effects on combustion at low engine speed but became progressively more effective above 2000 rev/min. At an engine speed of approximately 3000 rev/min, when the TCI design might be expected to produce a maximum power output of 19 kW (25 bhp), the gas jet velocities were roughly equal to those attained with a TCI design used in a Triumph 2500 gasoline engine operating at its maximum power output at 4250 rev/min. Engine speeds in these tests were limited to 2500 rev/min to obviate the need for valve springs of greater strength than those fitted as standard, the engine normally being governed to 2000 rev/min. The improvement in combustion with increasing engine speed was reflected in improved fuel economy over the load range. The TCI engine suffered a slight reduction in volumetric efficiency, except at low speeds; but this was insufficient to prevent the increased power output at high speed. Over the entire load range at 2000 rev/min, an improvement in 10% in fuel economy and a substantial reduction in smoke emissions were maintained by the TCI engine. Performance improvements achieved at high speed indicate the possible extension of the operating speed range of the direct-injection diesel engine and the consequent raising of specific power output levels. Potential improvements are also indicated for naturally aspirated automobile engines, as well as for future application to turbocharged engines.

by A. O. Dye  
Publ: Automotive Engineer v3 n5 p81-3 (Oct-Nov 1978)  
1978; 4refs  
Availability: See publication

HS-024 609

# **RESTRAINING YOUR CHILD [RESTRAINT SYSTEMS IN AUTOMOBILES]**

Basic information about child and infant restraint systems to provide protection during automobile travel is presented. Auto accidents are the number one cause of death among children, mainly because many parents do not take the necessary precautions to safeguard their children in cars. The solution is to buckle infants and toddlers into crash-tested car restraints during every trip in a car. In general, these restraints should distribute the pressure of the body over the largest possible area, provide good support for the head and neck to guard against whiplash injury, and be secured by either a standard lap belt through or around the child restraint or anchored directly to the floor of the vehicle. Approved restraints for children fall into the following five groups: "bucket" type (suitable for infants up to 20 pounds, designed for baby to ride backwards in a semireclining position); reversible seats (suitable for infants when placed in a backward-riding position, tilting up and facing forward for toddler and older child up to 40 pounds); chair-type restraint with 5-point harness (for children weighing from 15 pounds, able to sit up unaided, to those weighing 40 pounds, about 4 years old); 5-point harness alone, secured by a strap around the seat back and bolted to the floor or to the rear window shelf (for children able to sit up unaided from 15 to 50 pounds); curved C-shaped shield for use with the standard safety belt (for children over 20 pounds). Some infant restraints have their own snap-on shields for use by older children. Old seats which merely hook over or under the passenger seat do not protect. When purchasing a car restraint, the size of both the child and the car must be considered. For restraints to provide protection, they must be fastened securely by the adult's safety belt, the tether straps

(if provided) should be fastened tightly, and all other manufacturer's instructions should be followed. The parent's attitude has a lot to do with how well the child adjusts to using the restraint. Other important facts are that a child and a parent cannot use the same lap belt, that two children cannot use the same lap belt, that an infant is not safe in an adult's arms, that a pregnant woman can wear safety belts, that car beds do not provide crash protection, and that air bags will provide adequate protection if used in conjunction with restraints. It is important to spread the message that using child restraints is critical for crash survival. Addresses are provided for obtaining brochures on crash-tested restraints currently on the market.

Publ: Driver v12 n5 p16-8 (Oct 1978)  
1978; 3refs  
Availability: See publication

HS-024 610

## **DO YOU REALLY NEED A BIGGER HAMMER? PT. 2, BASIC DENT REMOVAL**

Step-by-step instructions on how to remove automobile dents (and accompanying photographs) are provided for the amateur mechanic. The hammer-off-dolly technique is recommended for beginners. In this procedure, the dolly block is positioned next to the hammer's target (instead of behind, as with the hammer-on-dolly technique). Hammer strokes lower high spots; rebounding dolly raises low portion. Information is presented on how to analyze the damaged auto body and to map out the area to be hammered; how to use the hammer-off-dolly technique; how to roughen up the metal surface; how to prepare, apply, work, and sand the coats of plastic filler; and how to apply and sand spot putty. A \$100 dent can be worked out in about three hours by most amateurs.

Publ: Driver v12 n5 p22-7 (Oct 1978)  
1978  
At head of title: The Backyard Mechanic.  
Availability: See publication

HS-024 611

## **NATIONAL TRANSPORTATION STATISTICS. ANNUAL REPORT**

Time-series U.S. transportation statistics are compiled for the period 1966-1976, including energy consumption and supply-and-demand data for the same period and extending back to 1950. The data have been obtained from a wide variety of government agencies and trade associations; sources are noted on the same page as the data or in the bibliography. Four different formats (tree displays, modal profiles, performance indicators, and transportation trends) are used to spotlight various aspects of the major transportation modes. Included are cost, inventory, and performance data describing the passenger and cargo operations of the following modes: air carrier, general aviation, automobile, bus, truck, local transit, rail, water, oil pipeline, and gas pipeline. Basic descriptors of U.S. transportation, such as operating revenues and expenses, number of vehicles and employees, vehicle miles and passenger miles, are included. Two supplements detail the role of transportation in the economy and the relation of energy to transportation, the latter divided into three parts: energy consumption, energy transport, and energy supply and demand. The operating costs of automobiles of different sizes for 1967,

1972, 1974, and 1976, are appended. In order to clarify definitions, a glossary has been assembled, divided according to transportation modes.

Transportation Systems Center, Transportation Information Div., Kendall Square, Cambridge, Mass. 02142  
Rept. No. DOT-TSC-RSPA-78-13; 1978; 188p refs  
Rept. for Jan 1966-Dec 1976.  
Availability: GPO

HS-024 612

## **ALCOHOL, DRUGS AND ACCIDENT RISK**

The potential for bizarre interactive effects of multiple drugs (including alcohol, prescribed medications and illicit drugs), clearly exists, resulting in impairment of perceptual, cognitive and motor functions and increased accident risk. Attention has been directed in Australia mainly towards alcohol and traffic accidents, probably because of the relative ease of data collection and the existence of prescribed blood alcohol limits for drivers. The role of other drugs in traffic accidents is much more difficult to pinpoint because of the very large number of agents involved and the fact that in some cases a driver will be safer with medication than without it. Nevertheless, a wide variety of drugs can be shown to produce decrements in perceptual and psychomotor performances. Psychoactive drugs of all types are the most obvious contenders, but those which affect visual acuity or sensitivity to light also could affect driving ability. Drugs in the latter group have no predictable pattern of activity, and their effects must be assessed on an individual basis. In order to provide meaningful advice to his patients, the physician must be aware of the likely effects of the drugs he prescribes on driving performance; unfortunately such information is not available in most cases. Also lacking is available information on the interactions of prescribed drugs with alcohol. Drugs may modify the absorption, distribution, metabolism and excretion of alcohol, and vice versa. Blanket prohibition of alcohol ingestion while under medication is inappropriate in most cases and is unlikely to be observed. There is a need to establish valid measures of driving skills and relate these to the use of drugs at different dose levels and at different periods of time after administration. The relationship of degree of impairment to plasma drug concentration must be determined as well. A public education program on the drug/accident relationship is long overdue.

by G. A. Starmer  
Publ: Medical Journal of Australia v65 p78-9 (28 Jan 1978)  
1978; 14refs  
Availability: See publication

HS-024 613

## **THE INCIDENCE OF AUTOMOBILE POLLUTION CONTROL**

The incidence of a motor vehicle tax to reduce automobile pollution in the U.S. is examined over all affected groups (i.e. consumers, stockholders, pollution sufferers, and government expenditure beneficiaries) by income class. Although present automobile pollution controls do not involve explicit taxes, they are roughly similar to a program under which the Federal government levies a unit ("lump sum") tax on new cars and spends the proceeds to equip these cars with pollution-control devices. Gains and losses are estimated under alternative assumptions about industry pricing. The net effect of the tax is

regressive if government expenditure benefits are distributed neutrally. Under different expenditure assumptions, the tax effect becomes progressive. Although the progressive effect of current Federal controls on automobile pollution may appear salutary, there is no ready comparison with alternative approaches. Results suggest that a tax on the actual emissions rather than the individual vehicles may be more equitable as well as more efficient.

by Peter Asch; Joseph J. Seneca  
 Publ: Public Finance Quarterly v6 n2 p193-203 (Apr 1978)  
 1978; 24refs  
 Sponsored by Rutgers Univ. Res. Council.  
 Availability: See publication

## HS-024 614

### **MVMA [MOTOR VEHICLE MANUFACTURERS ASSOCIATION] MOTOR VEHICLE FACTS AND FIGURES '78**

Comprehensive statistical information is compiled on the U.S. and Canadian motor vehicle manufacturing industry for 1977 (and some previous years for comparison purposes), including overview, production/registrations, use and owners, and economic impact sections. A subject index is provided. Capsule comments on each page offer general observations about specific tabulated and graphical data. The following data are representative items from each section. North American production of motor vehicles in 1977 approached 14.5 million (12.7 million in the U.S., 1.8 million in Canada). Motor vehicle factory sales from U.S. plants of 12,639,291 surpassed the record set in 1973. Motor vehicle registrations of 143.8 million exceeded 1976 by 3.8%, passenger cars accounting for 114.1 million, the remaining 29.7 million comprising trucks and buses. Four of five new car purchases involved a trade-in. Four of every five households own one or more cars; one of every five owns a light truck. More than 85% of household heads travel to work in a private motor vehicle. While preliminary data show the number of traffic fatalities increased 2500 to 49,200 in 1977, the rate per 100 million vehicle miles held stable at 3.3. Employment in the motor vehicle and equipment manufacturing industries exceeded 890,000 in 1977, and nearly one of every five U.S. workers is employed in the manufacture, distribution, maintenance, or commercial use of motor vehicles. Nearly two of every three U.S. communities are without rail service and are dependent on the motor vehicle for transportation. Highway vehicles account for \$8 of every \$10 of expenditures for passenger and freight transportation. Special state and Federal motor vehicle use taxes exceeded \$22 billion in 1977. Motor fuel taxes contributed \$9.2 billion of the total \$15.4 billion state highway user tax revenues in 1977.

Motor Vehicle Manufacturers Assoc. of the United States, Inc., 300 New Center Bldg., Detroit, Mich. 48202  
 1978; 101p refs  
 Availability: Corporate author

## HS-024 615

### **TYRE [TIRE] TRENDS FOR COMMERCIALS**

Data gathered by Pirelli, the Italian tire manufacturer, indicate that, by 1983, 92% of all tires sold to heavy-vehicle manufacturers in the U.K. will be of radial ply construction, with 66% of them being of the tubeless variety. Not only has this type of tire a lower rolling resistance but also a lighter wheel/tire

assembly. For light commercial vehicles, radial ply tires will take over more slowly, although many manufacturers are considering this type for production in the early 1980's. The effect of the swing to radials, in both the original-equipment and replacement markets, will be a reduction in the rate of growth of tire sales, due to the higher mileages provided by radial ply tires. On the other hand, because of the trend to heavier vehicles (e.g. increase in 28-ton-plus category from 8.4% in 1973 to 18.2% in 1977) and the consequent increase in the number of wheels per vehicle, sales of replacements in this category will increase. The trend of average costs relative to the increase in retail price index over the past ten years indicates that tires could be underpriced. Pirelli envisages a demand for wide, low-profile tires for the 1980's, and is at an advanced stage in developing these tires. The potential advantages include lower rolling resistance, lower temperatures, higher mileages, higher load-carrying capacity, better braking performance, and lower platform height. The advantages differ according to whether wheels of the same or larger diameter than those of the corresponding conventional tires are used. Pirelli development testing consists of several distinct stages: laboratory testing, including dynamometer tests (detail and destructive tests, tests for basic characteristics, such as cornering force), and two separate outdoor series of tests (destruction by 100% overload on a figure-eight track at a constant speed of 37 kph (23 mph) and a wide range of tests at a fully-instrumented and computerized test track complex). The last series of tests involve steering and handling (steady state and the assessment of transitional behavior). Tire tread patterns, aquaplaning, and resistance to abrasion, tread cutting and stone trapping are tested on special track sections.

by Ken Garrett  
 Publ: Automotive Engineer v3 n5 p57-9 (Oct-Nov 1978)  
 1978  
 Availability: See publication

## HS-024 616

### **EXHAUST SYSTEMS: A CASE IN POINT [FAILURE MODES]**

Both service-life studies and common experience have established the occurrence and likelihood of failure of certain automotive exhaust components before others, the failure occurring regardless of differences in conventional steel usage and being closely related to location along the system. The front exhaust tubing ahead of the muffler generally tends to exhibit greater durability and service life expectancy than the muffler or other downstream components, often remaining sound after four or more years. This exhaust tubing is usually made of greater steel thickness, and the high-temperature corrosive/oxidative environment, both internal and external, has an apparently minimal deteriorating effect in this region. Some internal attack is usually observed after extended periods, but wall penetration is rare. Exterior damage should be minimized by the temperature, limited recesses for corrosion, and absence of cold condensate. Catalytic converters are apparently not changing this extended durability experience, except for the outer tubing wall of laminated front and intermediate exhaust pipe, where external corrosion effects can result from lower external temperatures and moisture retention. Exhaust system components exhibiting the least durability include the muffler, resonator (if present), and related kick-up and tailpipe components. These are exposed variously to the most severe elements of the deteriorating exhaust environment including localized and general external corrosion, inter-

nal hot corrosion, cold-condensate corrosion, and mechanical deformation effects. These components also tend to be thinner than those in the forward part of the exhaust system. Specific failure modes and sites depend on a combination of component and operating factors, including steel usage, major driving mode, and external corrosive conditions. The most rapid form of exhaust system deterioration is that resulting from internal cold-condensate corrosion, when it is the predominant failure mode. Substituting stainless or other premium steels, or making other significant material or design changes, would alter the traditional concepts of exhaust-system durability and service life.

Publ: Automotive Engineering v86 n11 p30-3 (Nov 1978) 1978

Based on SAE-780921 "Materials, Design and Corrosion Effects on Exhaust-System Life," by William R. Patterson. Availability: See publication

HS-024 617

### THE CHANGING CHEMISTRY OF EXHAUST GAS: HOW WILL IT AFFECT CORROSION?

An attempt has been made to compare presence and content of sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and other acids in muffler condensate collected from cars with catalytic converters and those without. A water-cooled stainless steel condensing coil was mounted parallel to the muffler of various 1973, 1974, and 1975 model cars. Several road-load operating conditions were simulated using a chassis dynamometer, following suitable purging before condensate collection. Condensate from converter cars was found to range in H<sub>2</sub>SO<sub>4</sub> content from rather modest levels (15 mg/L (liter) to 46 mg/L) to an extraordinarily high level (740 mg/L), the type of converter substrate form, pelletized or monolithic, appearing to account for the large differences. For the pre-converter cars, H<sub>2</sub>SO<sub>4</sub> content ranged from 98 mg/L (typical of nonconverter-era condensates) to an extraordinarily high value of 929 mg/L (for which there is no ready explanation). Total chloride and bromide values of these condensates (and, by inference, the combined hydrochloric acid and hydrobromic acid contents) varied unexpectedly for leaded and unleaded fuels. For unleaded fuel, converter condensates varied in chloride plus bromide from 2 mg/L to 13 mg/L, confirming the likelihood that some lead-scavenging agent is present even in so-called lead-free fuels. For the leaded fuel, nonconverter condensates ranged from 48 mg/L to 74 mg/L (in agreement more or less with nonconverter-era condensates). The most unusual aspect of these condensate analyses is the extraordinarily high nitrate (NO<sub>3</sub>) value reported in all cases. The values ranged from 4430 mg/L to 6034 mg/L, implying a high corresponding nitric acid (HN03) content. No significant difference is apparent between converter and nonconverter condensates. The NO<sub>3</sub> values probably result from condensate collection technique, although the possibility of HN03 generation does exist. Water vapor condensed on downstream components at temperatures below the dew point could interact with the flowing exhaust gas (containing nitric oxide and oxygen), leading to HN03 formation. HN03 also could be formed during cold start-up or other driving modes where exhaust component temperatures remain below exhaust gas dew point.

Publ: Automotive Engineering v86 n11 p34-8 (Nov 1978) 1978

Based on SAE-780921 "Materials, Design and Corrosion Effects on Exhaust-System Life," by William R. Patterson. Availability: See publication

HS-024 618

### CORROSION PROTECTION: A 'MUST' FOR ELECTRICAL SYSTEMS

Means of providing corrosion protection for automotive electrical components are discussed. A large variety of chemical compounds are used to reduce corrosion of these electrical components, sealing out air, moisture, and harmful chemicals, increasing lubricity, and reducing thermal degradation. Organic and inorganic coatings which serve these various purposes are outlined, including paints, primers, varnish and resin systems, plastisols--sealers, silicone compounds, metallic coatings, and oils and greases. Many compounds serve dual purposes such as magnet wire enamel and varnish impregnant on an alternator field. The insulation system serves as a dielectric, resists vibration, and protects the copper wire from corrosion. Automotive electrical components generally utilize some form of disconnectable electrical interface to the vehicle body harness. Commonly-used current-carrying materials include steel, brass, copper, phosphor bronze, and beryllium copper, each of which exhibits varying degrees of corrosion susceptibility. Use of the appropriate material in a given application is often possible, with no other preventative measures. Some of the general characteristics of these base metals are provided. Many applications require additional protection of the base metal, since addition of plating alters performance of the base metal. Actual corrosion prevention performance of a given plating is influenced by plating bath type, plating porosity, coating thickness and purity, and the galvanic potential of nearby surfaces. Zinc, cadmium, copper, nickel, tin-zinc, tin, silver, and gold types of plating are described. Automotive electrical interfaces exist for which even the best selection of base metal and plating cannot provide necessary termination protection. Underhood environment severity coupled with electrical characteristics of the application may require additional protection, often achieved by sealing grommets and connector bodies. Advantages and disadvantages of the two types of sealing grommets, molded-on and insertable, are outlined.

Publ: Automotive Engineering v86 n11 p42-5 (Nov 1978) 1978

Based on SAE-780294 "Electrical Component Corrosion Prevention," by M. Michael Jones and Edward E. Welker. Availability: See publication

HS-024 619

### STAINLESS/ALUMINUM TRIM PAIRING HELPS PREVENT CORROSION

Though Type 434 stainless steel (a 1% molybdenum modification of straight chrome Type 430 ferritic alloy) used in automotive trim has excellent corrosion resistance in today's severe road environment which includes increased use of slag, cinders, and deicing salts to reduce road hazards in snowbelt areas, rust blistering is encountered at damaged paint areas near the trim. Exposed body steel corrodes more rapidly in the presence of stainless steel due to galvanic action between dissimilar metals in the presence of a salt-water electrolyte. Over the past few years, an approach to minimizing this problem was investigated in which a metal (aluminum) lower in nobility (below iron in the electromotive force series) was used in conjunction with the stainless; aluminum acts sacrificially to the auto body and slowly gives itself up to protect the body steel. Test moldings were made from a stainless(40%)-aluminum (60%) composite, with Type 434 stainless on the outer surface and aluminum on the concave side. This system provides an

excellent visible exterior plus the protective behavior of aluminum. Test moldings were field tested over long periods under highly-corrosive winter conditions, as well as under marine environments. In all cases the stainless-aluminum composite was highly effective in minimizing corrosion of body steel, even at paint damage areas as far as 12 mm from the molding. In many cases nearly complete corrosion protection of the body steel was observed adjacent to the stainless steel trim.

Publ: Automotive Engineering v86 n11 p46-9 (Nov 1978)  
1978

Based on SAE-780917 "Corrosion Behavior in Automotive Trim Applications," by L. S. Redmerski.

Availability: See publication

## HS-024 620

### GM [GENERAL MOTORS] RESEARCH LOOKS AT ALTERNATIVE FUELS

Investigators at General Motors (GM) Res. Labs. see alternative-sourced gasoline and diesel fuel as optimum responses to the dwindling supply of low-cost petroleum. GM studies indicate that the coal and oil shale in the U.S. can be exploited to maintain a mobile society, but energy supply leadtimes involve a critical need for current action. After reviewing world petroleum reserves, as well as other available energy resources in the U.S., researchers computed depletion times within several scenarios of growth, and energy conversion rates for each of the alternative fuels. They also examined cost estimates, in terms of fuel pricing and investment required for development of a wide variety of hydrocarbon alternatives. One of the study's principal conclusions is that the transition from petroleum-based fuels would be simplified greatly, from the standpoints of fuel distribution and marketing as well as vehicle design, if synthetic gasoline and diesel fuel (derived from oil shale and/or coal) can be produced in sufficient volume at reasonable cost. Compounding the leadtime problem are extremely large resource requirements in terms of capital, labor, and materials. GM researchers also note that perhaps the most serious constraint on development of alternative fuels is a potential government threat of oil industry divestiture, which might not only reduce integration, but also prohibit involvement in other energy ventures. Recognizing the technology and large investments required to commercialize alternative fuels, GM researchers observe such development is unlikely to be accomplished by other than the existing energy companies.

Publ: Automotive Engineering v86 n11 p50-4 (Nov 1978)  
1978

Based on "Automotive Fuels--Outlook for the Future," by Joseph B. Bidwell.

Availability: See publication

## HS-024 621

### DISPLACEMENTS AND STRESSES RESULTING FROM CONTACT OF A STEEL BELTED RADIAL TIRE WITH A FLAT SURFACE

The displacements and stresses in a steel-belted radial tire in contact with a flat surface are analyzed by the use of the finite-element method. The tire configuration is modeled by using flat, triangular plate elements. The radial profile is divided into four zones, each zone assumed to be piecewise homogeneous. The material properties for each zone are ob-

tained directly from a separate experimental study. Such laminate property is included in the formulation of the stiffness matrix of the triangular plate element. An incremental stiffness matrix based on the quadratic terms in the strain-displacement equations is also formulated for the element. The geometrically-nonlinear behavior of the finite-element model is predicted by a linear incremental procedure. The distributions of displacement, membrane stress, and bending stress throughout the tire are computed. The results for sidewall deflections resulting from inflation and the spring constant of the tire are compared with experimental measurements. The most important results are for the stress distributions within the tire. The emphasis was on obtaining general trends rather than highly accurate values. It was found that membrane stresses are of primary importance compared to bending stresses in the load-carrying capacity of the tire. Contact displacements mainly affect the stress distribution close to the contact zone while their effects away from the contact zone are negligible. The radial membrane stress resultants along the radial profile (stretching of the radial profile) resulting from inflation are moderate and constant throughout the tire. Contact displacements create large radial stresses in the contact profile, especially in the shoulder and flap sections; this is true for the circumferential stress in the belt section. Circumferential components of membrane and bending stress resultants are carried only by the steel belt.

by Jozef DeEskinazi; T. Y. Yang; Werner Soedel

Publ: Tire Science and Technology v6 n1 p48-70 (Feb 1978)  
1978; 16refs

Sponsored by Cooper Tire and Rubber Co.

Availability: See publication

## HS-024 622

### A NOTE ON A NEW TIRE CORD ADHESION TEST

A new tire cord adhesion test has been developed for measuring rubber-to-cord adhesion. Although developed to evaluate rubber-tire cord adhesion, it can be used generally to evaluate rubber-cord adhesion in other products, such as belts or hoses. The test piece contains two opposite, symmetrically-embedded cord ends that are pulled during testing. Failure is initiated at the cord ends and propagates as an adhesive failure until one cord becomes detached. The test is very reproducible and is capable of giving high-quality statistical data. A typical force-deflection curve for an adhesive failure is provided.

by D. W. Nicholson; D. I. Livingston; G. S. Fielding-Russell; A. N. Gent

Publ: Tire Science and Technology v6 n1 p71-3 (Feb 1978)  
1978

Availability: See publication

## HS-024 623

### CHILD RESTRAINT SYSTEMS FOR CIVIL AIRCRAFT

To provide basic data on the performance of child restraint systems in a civil aircraft environment, tests were conducted on a variety of systems selected to provide data representative of several basic design approaches. All systems tested required only a seat belt for installation so that the test would be applicable to operational civil aircraft without modifications. The following systems were exposed to controlled impacts on a test sled to simulate aircraft crash conditions, and were in-



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HS-024 626

verted to simulate turbulence: a vest-type restraint that attached directly to the seat belt (Sears/Rose), "shield" devices without straps (Ford Tot-Guard, Mopar, Peterson Toddler), "infant carrier" devices (Peterson Infant, General Motors Infant Safety Carrier), and plastic shell and webbing restraint (Peterson Child, Bobby-Mac). A special test seat was developed to represent an aircraft passenger seat. The performance of the child restraint systems in these tests must be considered relative to their intended goals but with full regard for their practical use in the field. Descriptions of the characteristics of the restraint systems, their performances in the dynamic and turbulence tests, general comments about the systems, and photographs and diagrams of response of dummies and restraint systems during impact are provided. It is concluded that the test program provided a reasonably severe evaluation of child restraint systems, and that the basic concepts leading to this test program can be incorporated into a test specification to establish a repetitive test method. A uniform test procedure must be established, guidance must be provided regarding allowable locations for child restraint seats in the aircraft (to prevent blocking of emergency exits), and a means of notifying the public and aircraft operators of the acceptable seats must be devised. New labelling would also be required for aircraft use of automotive child restraints.

by Richard F. Chandler; Edwin M. Trout  
Federal Aviation Administration, Civil Aeromedical Inst., P.O. Box 25082, Oklahoma City, Okla. 73125  
Rept. No. FAA-AM-78-12; AD-A053565; 1978; 43p 20refs  
Availability: NTIS

HS-024 624

### **EQUIPMENT MAINTENANCE: AN AID TO TIRE SALES**

The basic shop equipment used in the tire business and methods for maintaining it in proper condition are discussed. These maintenance tips are not intended to replace manufacturer-recommended operation procedures, but to provide additional information in maintaining the following operative service tools and equipment found in the tire service specialist's shop: tire, steering, and suspension equipment, such as modern tire changer (air or electric), air gauges, wheel balancers (static and dynamic), tire spreader, wheel alignment equipment and calibration tools, tire repairing equipment and materials, and tire and automotive special tools; brake adjustment equipment, such as brake drum and disc lathes, pressure brake bleeders, brake testers, brake drum micrometer, wheel cylinder honing equipment, and brake tools; and general shop equipment, such as vehicle lifts and hoists, lubrication equipment, floor jacks, safety stands or work stands, torque wrenches, parts cleaners, technical service literature, and housekeeping supplies. A table lists items of equipment and indicates what maintenance procedures should be performed on a daily, weekly, monthly, or annual basis.

Publ: NTDR Dealer News v41 n19 (20 Oct 1978)  
1978; 7p  
At head of title: The Tire Service Specialist.  
Availability: See publication

HS-024 625

### **1977 NORTH DAKOTA VEHICULAR ACCIDENT FACTS**

Statistical data, as compiled from state files maintained for traffic accident experience, are presented for vehicular accidents which occurred on all highway systems within North Dakota during 1977 (with some previous years' statistics included for comparison purposes). Details for all motor vehicle accidents resulting in death, personal injury, or property damage in excess of \$300, are represented in tables and graphs. A map of the state indicates the fatality rate, based on deaths per 100 million vehicle miles traveled, for each county. The state rate for 1977 was 3.63 compared to a national rate of 3.25. A summary of facts and figures includes the following information: 17,577 traffic accidents; 180 persons killed; 6346 persons injured; 45% of fatal accidents occurring after dusk and before dawn; 64% of fatal accidents occurring on dry surface with clear weather conditions; 7.2% of all licensed drivers involved in a traffic accident; 79% of all fatalities male; 40.5% of those killed between the ages of 14 and 24, accounting for 38% of all male fatalities, and 50% of all female fatalities; 58% of fatal accidents involving a single motor vehicle; 61% of fatal accidents occurring in urban (and 39% in rural) areas; 39% of all fatal accidents occurring on Saturday through Sunday; a reportable accident occurring every 30 minutes; one person injured every 1 1/2 hr; one person killed every 2 days; and passenger cars representing 63% of vehicles involved in accidents.

North Dakota State Hwy. Dept., Transportation Services Div., Bismarck, N. Dak. 58505  
1978; 27p  
Availability: Corporate author

HS-024 626

### **A DISAGGREGATE MODEL OF AUTO-TYPE CHOICE**

Previous aggregate econometric models of auto-type choice have not included as explanatory variables the whole array of automobile characteristics which affect consumers' choices of type and number of automobiles to own. These earlier models have used only price and fuel economy as explanatory variables, omitting other characteristics such as weight, external dimensions, passenger space, and horsepower. Inherent problems with the aggregate econometric approach make inclusion of these latter variables difficult, if not impossible. In view of this limitation, a disaggregate model of the household's car-buying decision was developed, estimated on a stratified, random sample of 1976 new-car buyers in seven cities. The universe of new car types is classified into ten size/price categories. Multinomial logit analysis is used to estimate the probability of choice among these ten categories, as a function of a variety of car, household, and driving environment characteristics. The resultant model fits the data quite well, and all of the variables enter with the correct signs and reasonable significance levels. Preliminary sensitivity checks indicate that changes in the policy variables influence market shares in the expected direction, and with plausible magnitudes. Using the model, the effects of an increase in gasoline



HS-024 627

taxes and an excise tax on larger cars were tested, and the results tabulated by vehicle weight class (new cars only).

by Charles A. Lave; Kenneth Train  
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Systematics, Inc., Berkeley, Calif. 94704  
Rept. No. UCI-ITS-SP-78-4; 1977; 33p 14refs  
To be published in "Transportation Research." Research  
sponsored by Dept. of Energy.  
Availability: Reference copy only

HS-024 627

## ROBOTS IN THE AUTOMOTIVE INDUSTRY

Although a robot's programmability sets it apart from "hard automation", the robot's ability to follow a complex path repetitively is usually the attractive feature to the auto industry. For example, in body welding, the robot is a very simple alternative to a multiwelder. It has the added advantage that if one robot fails, the remaining welds may be performed manually or by a spare robot, whereas with a multiwelder the whole line stops. Of general-purpose robots, the best-known is the Unimate. More recently, special-purpose robots, made by KUKA, Sciaky, and Comau (Fiat), have been designed for welding applications, and those by Trallfa for painting. Most robots intended for welding and assembly are operated electrically, although the new Sciaky modular welding robots are hydraulic. Since General Motors set up its Lordstown plant about nine years ago in which 11 five-axis Unimates were used in the latter stages of the body framing operation (usually called "respotting"), Volvo, Saab, Fiat, Nissan, and Mitsubishi have used robots extensively in respot operations with multiwelders generally used for the initial framing operations. In Fiat's Robogate concept, all welding during framing and the respot areas is done by robots, with no multiwelders being needed. In addition, the overall manning level is very low (25 men including maintenance personnel replacing 125 men) as is the cost of changing the body design. The Robogate itself is a four-post structure, arranged so that two robots can be suspended from the overhead gantries incorporated in the structure, while all the control equipment is installed on overhead walkways. In addition to the two overhead robots, four robots can be mounted at floor level (two each side), although in practice so far there are only four robots at a Robogate. A number of these Robogates are installed in parallel and the body is transferred on a radio-controlled trolley throughout the system. To the manufacturer, the Robogate offers productivity and quality advantages. Although growth in the use of robots for welding and handling is certain, the future in assembly is much less clear, but equally promising. The future of robots may lie in doing unpleasant jobs at unpopular hours. It is important that these machines remain the slaves, not the masters, of the human work force.

by John Hartley  
Publ: Automotive Engineer v3 n5 p14-6 (Oct-Nov 1978)  
1978; 1ref  
Availability: See publication

HS-024 628

## FAILURE RECOGNITION REQUIRES UNDERSTANDING OF CORROSION

Basic information on the various types of corrosion and ways to protect against them is presented to provide the designer

HSL 79-07

with the data needed to make informed choices about materials and protection methods. An understanding of corrosion fundamentals is basic to prevention of chemical and electrochemical deterioration. The following types of corrosion are discussed individually: galvanic corrosion, direct attack, fretting corrosion, stress corrosion, crevice corrosion, corrosion fatigue, intergranular corrosion, hydrogen embrittlement, selective leaching by dezincification or graphitization, caustic embrittlement, erosion corrosion, and cavitation erosion. Representative protection methods include a "sacrificial" coating of zinc on steel to prevent galvanic corrosion; use of a weathering steel or ceramic coating to prevent direct attack; and reduction of relative motion at the interface, increasing steel hardness, or lubrication to prevent fretting. Stress corrosion can be minimized by avoiding residual stress, using protective coatings, or selecting proper alloys. Protection from intergranular corrosion is provided by reheat treating stainless steel, or by using stainless steels stabilized by columbium, titanium, or tantalum, or stainless steels low in carbon. Post-baking parts after plating will minimize hydrogen embrittlement, and addition of tin, arsenic, antimony, or phosphorus can reduce the tendency to dezincification. Damage by caustic embrittlement can be reduced by shot peening or other mechanical methods of relieving internal stresses. Proper alloy selection is recommended to reduce erosion corrosion, as are reduced velocity, use of baffles, and filtering of insoluble abrasives. Proper material selection (stainless steels and aluminum bronzes) and protective coatings offer the best protection against cavitation erosion.

Publ: Automotive Engineering v86 n11 p26-9 (Nov 1978)  
1978

Based on SAE-780924 "Electrical Component Corrosion Prevention," by M. Michael Jones, and Edward E. Welker.  
Availability: See publication

HS-024 631

## STATE OF THE U.S. AUTOMOTIVE INDUSTRY

An assessment of the present status of the U.S. automotive industry is presented, and important factors affecting the industry's future are discussed, reflecting the industry's concerns over the effects of present and future automotive regulations. The discussion is presented in sections on the importance of the auto industry to the economy, health of the U.S. manufacturers, Ford product program requirements, Japanese imports, productivity, the regulatory burden (emissions, fuel economy, trucks, cumulative effect of regulations, risks), and inflation. It is emphasized that all involved agencies and levels of government appreciate the cumulative impact of present and planned regulations, including the costs and the risks. It is stated that it is time to slow down or call a halt to the process of continually adding regulations, setting more stringent standards, and tightening existing standards administratively. The auto industry, it is expressed, is devoting its full energies to meeting the standards already prescribed by laws and regulations, but it still is faced by more governmental requirements such as the investigation of the competitiveness of the auto industry by the Federal Trade Commission. It is recommended that the President's Regulatory Analysis Review Group undertake a comprehensive review of major automotive standards and regulations beyond those applicable to 1979 models; the Group should determine whether the costs exceed the public benefit, and whether other choices would be more beneficial for the American public. The concept of a regulatory budget by which to assess the trade-offs in the national in-

terest and to cap the cost burdens to the public is supported. Specific recommendations in the regulatory area include no increase in 27.5 mpg car fuel economy standard for 1985, reexamination of front-loaded car fuel economy annual increases of 2 mpg in 1981-1983, establishment of reasonable truck standards for 1982-1984 on a timely basis, and granting of a waiver for the 1981 carbon monoxide standard of 3.4 g.

Ford Motor Co.

1978; 40p

Availability: Reference copy only

HS-024 632

# **ASSESSMENT OF THE APPLICATION OF AUTOMATIC VEHICLE IDENTIFICATION TECHNOLOGY TO TRAFFIC MANAGEMENT. APPENDIX A: REVIEW OF AUTOMATIC VEHICLE IDENTIFICATION TECHNOLOGY AND CANDIDATE APPLICATIONS. FINAL REPORT**

An overview of AVI (automatic vehicle identification) technology for potential traffic management applications is provided. The principal components of AVI (transponder, interrogator, communication system, computer) are described and their associated functional characteristics discussed. Candidate AVI technologies include radioactive, acoustic, magnetic, license-plate scanning, microwave, infrared scanning, visible optical scanning, and radio-frequency systems. The present status of AVI development and possible extensions are examined. Three major AVI capabilities that can be used, in differing degrees, to support a number of traffic management strategies are identified and discussed; these are automatic user charges, access control, and data collection. The following specific traffic management applications of AVI technology are examined in detail: roadway "point" pricing, area licensing, roadway pricing (ubiquitous), toll roads, lane usage restrictions (closed system), lane usage restrictions (open system), traffic signal control (off-line optimization), traffic signal control (on-line control), traffic signal control (bus priority), traffic signal control (emergency services), traffic corridor control, and transportation data collection. A review of potential applications of automatic vehicle monitoring (AVM) and automatic vehicle location (AVL) technology for traffic management is presented. Passive and active AVM and/or AVL system(s) capabilities are described, and the following candidate applications for AVM and/or AVL system(s), which are complementary to a comprehensive AVI system, are described individually: traffic signal control (bus priority), traffic signal control (emergency services), fleet monitoring (taxicabs), and fleet monitoring (police).

by R. A. Ferlis; R. Aaron

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036; Peat, Marwick and Partners, Toronto, Ont., Canada; Casciato, White and Associates, Toronto, Ont., Canada  
DOT-FH-11-9198

Rept. No. FHWA-RD-77-88; PB-282 659; 1977; 58p 18refs

Availability: NTIS

HS-024 633

# **SURVEY OF VEHICLE HANDLING**

A review of research on the subject of vehicle handling is presented in an introductory section (safety, the driving task,

and objectives of vehicle handling research). Following sections include vehicle dynamics (steady-state response, transient response), measurement of vehicle characteristics (stability factor, transient response), and driver/vehicle handling studies (experimental approaches, experimental tasks and performance measures, effect of vehicle variables on handling performance, free control studies). It is concluded that vehicle handling research is necessary to determine the optimum vehicle characteristics for safety and precision of driving with the least workload demand on the driver. The dynamic behavior of vehicles in response to steering inputs can be described quite accurately by mathematical models. Both fixed and free control responses can be approximated adequately by second-order models. Variable-stability vehicles are the most useful tool in vehicle handling research; wide variations in vehicle parameters can be simulated, and experiments performed under real-world driving conditions. The driving tasks used in handling experiments must be representative of real driving situations, and must be sensitive to changes in handling variables; tracking tests and transient maneuvers are most commonly used. Performance measures must be able to discriminate among significant changes in performance caused by changes in vehicle variables. Subjective driver ratings should be more sensitive to changes in vehicle parameters than objective measures since drivers compensate for changes in the dynamics of vehicles to produce approximately the same overall performance. The most important fixed control parameters appear to be steering sensitivity, yaw response time, and stability factor; optima for these have been found for specific driving tasks, but experimental work needs to be extended to cover more general driving conditions, including the effects of steering wheel feel forces and free control characteristics on driving performance, and the effects of such roadway variables as lane width, delineation and curve design.

by A. D. Dorey

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Rept. No. HF-31; 1977; 84p 46refs

Sponsored by Australian Road Res. Board.

Availability: Corporate author

HS-024 634

# **THE DRIVER'S WORLD: ENGINEERING FOR THE MAN [TRUCK CAB DESIGN]**

Among current problem areas in truck cabs is the "driver seating package" (the seat, its placement in the cab, the available space around and above the seat, and controls). Areas under study for improvement are the distance between the steering wheel and back of the driver's seat, gear shift, controls, and pedal placement. Ride and vibration generally are conceded to be the items needing most improvement. Industry engineers have investigated four means of better ride: improved chassis suspensions, stiffer frames, use of suspension-type seats, and isolation of the cab from the chassis. In the area of "climate control", most truck cabs now offer passenger car comfort, as built-in heater/air-conditioner units are available for virtually all trucks. Cab ventilation has been much improved as well. In spite of steady improvement over the years in the area of driver visibility, some problems still exist (e.g. too-small rear window size in some cab models). Another aspect of driver visibility is the ability to see and read dashboard instruments and labels for controls or switches. The inherent problem in evaluating the readability of an instrument panel is that each panel must satisfy the needs of a driver population with a wide

range of visual abilities. One of the major improvements in instrument-panel visibility in recent years is the widespread use of fiber optics for glare-free lighting at night. A standard instrument layout has also been adopted on most, if not all, new truck models. Both exterior and in-cab noise has been given vigorous attention by engineers for many years. Under government regulation, all trucks manufactured after 1 Jan 1978 must not have a drive-by sound level exceeding 83 dBA. Although most U.S. truck makers have indicated they can meet the next level of sound reduction (80 dBA in 1982), they have said that major truck body redesign will be necessary to meet a 75 dBA level which some are advocating. Truck engineers agree that the entire industry is working diligently to better the driver's environment, but the element of uncertainty (e.g. possibility of Federal government preempting states on their size and weight laws) inhibits some developments.

by Jack Lyndall

Publ: Fleet Owner v73 n3 p69-77 (Mar 1978)

1978; 4refs

Availability: See publication

HS-024 635

### GOOD VIBES REDUCE STRESSES IN METAL PARTS

A practical alternative to thermal stress relief for reducing residual stress in most metal structures is a controlled vibration method known as vibratory stress relief (VSR). This technique applies low-amplitude, low-frequency vibrations to metal parts to stabilize their dimensions. VSR causes no metallurgical changes and does not reduce yield strength, tensile strength, or fatigue life. Equipment is simple, inexpensive, and easily brought to the part or structure to be treated. Vibration performs in minutes, or a few hours, what would otherwise require days to handle by thermal methods. Noise is within acceptable levels (80 dBA at 3 ft). Other advantages of VSR include: operating costs dramatically lower than those of energy-intensive thermal methods (vibratory units operate at 120 V or 240 V, using less power than a toaster); handling costs minimized or eliminated by bringing the process to the workpiece; ability of process to be used on any size workpiece or structure, without change in equipment or undesirable side effects, such as oxidation or scale; and clean operation (no ventilation or air-scrubber equipment required since VSR does not generate smoke, fumes, or gases). VSR has proved effective on most metals used today, although it is generally not effective on cold-worked metals (e.g. cold-rolled, drawn, spun, or strained metals), on nickel, aluminum, and titanium alloys that have been strain-strengthened or tempered, and on heat-treatable alloys in the precipitation-hardened condition. Unlimited use of VSR in the U.S. is hindered by the specifications for government work which limit all metal treatment for stress relief to the thermal methods. In view of the growing shortage of fuels, higher costs of materials and labor, and the need for a cleaner environment, at least a limited approval from government specifiers is expected.

by Donald R. Dreger

Publ: Machine Design v50 n13 p100-3 (8 Jun 1978)

1978

Availability: See publication

HS-024 636

### THE DRIVER'S WORLD: SLIPS AND FALLS [PROPOSED RULEMAKING FOR COMMERCIAL

### VEHICLE STEP, HANDHOLD AND DECK PLATE REQUIREMENTS]

More truck drivers are injured each year by slipping and falling from nonmoving vehicles than by any other single cause, according to industry studies. From the viewpoint of driver groups such as the Teamsters, slips and falls are an equipment and engineering problem, with regulatory reform needed. Opponents of this viewpoint, vehicle manufacturers, industry associations, and many large fleets, contend that adequate safety equipment is already available and that the problem is one of human motivation and education, with driver carelessness and poor safety training programs responsible for the problem. The Bureau of Motor Carrier Safety (BMCS), while admitting that a combination of approaches may be necessary, has initiated an important equipment-oriented regulatory proposal aimed at protecting the driver. Acting on evidence from a nine-month survey of the personal-injury experiences of 46 U.S. truck fleets, the BMCS director signed a Notice of Proposed Rulemaking in Feb 1978 that would amend the Federal Motor Carrier Safety Regulations to set forth specific criteria for commercial motor vehicle mounting systems, deck plating, and air- and electrical-connector locations. The BMCS study does not address the economic impact of the proposed regulation; but if it becomes law, it would impose the following equipment requirements on all commercial trucks and tractors manufactured after 1 Jan 1981: nonslip-surface steps and deck areas, and handholds as standard features of high-profile cab-over-engine tractors; nonslip steps, deck plates, and handholds at rear of vehicle for truck tractors; and handholds for grabrails and nonslip steps installed on the fronts of all trucks and truck tractors. The government contends that present adequate safety systems must almost always be specified as optional equipment, and thus carry a price penalty. This situation often results in a lack of adequate equipment in fleet vehicles for optimum driver safety, and a disincentive to retrofit extra-cost safety gear on older vehicles.

by Thomas W. Duncan

Publ: Fleet Owner v73 n3 p78-85 (Mar 1978)

1978; 1ref

Availability: See publication

HS-024 637

### APPROACH SPEEDS AT UNCONTROLLED INTERSECTIONS WITH RESTRICTED SIGHT DISTANCES

An unobtrusive study was made of vehicles approaching low-volume, uncontrolled intersections, with restricted right sight distances, at which the give-way-to-the-right rule was operative. The hypotheses were that one factor that influenced motorists' approach speeds on the major road was the frequency with which vehicles emerged from the right and that most drivers exceeded the safe approach speed when this probability was low. The mean speeds at a low- and a high-probability intersection were 31 mph (50 kph) and 22 mph (35 kph), respectively. (The maximum safe approach speed at each intersection was calculated to be 18 mph (29 kph).) It is concluded that many drivers believe that it is unlikely that a vehicle will emerge from the right or that the speed of an emerging vehicle will not necessitate evasive action by the drivers on the major road. It is also hypothesized that when drivers exceeded the safe approach speed, they were relying on taking evasive action to avoid a vehicle that might emerge from the

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right. In this connection, it is assumed that if drivers who exceed the maximum safe approach speed at the point of measurement do rely on being able to stop, then a reduction in the road surface friction just after this point should induce lower approach speeds. Alternatively, no consequent reduction in speeds suggests deliberate risk taking. (This argument assumes that the drivers feel that the reduction in friction has lengthened the minimum stopping distances for their approach speeds.) Whether a speed reduction reflects interaction between deliberate risk taking and reliance on evasive action depends on the relative magnitudes of any speed reductions that might be observed at each intersection. Measurements showed that reduced friction at the low- and high-probability intersections was accompanied by speed reductions of 3.0 mph (4.9 kph) and 3.5 mph (5.6 kph), respectively.

by S. Austin Lovegrove  
Publ: Journal of Applied Psychology v63 n5 p635-43 (Oct 1978)  
1978; 11refs  
Adapted from "Cognition and Speed Control for Road Safety," an unpublished doctoral dissertation submitted to Univ. of Melbourne, 1975. Sponsored by "The Sun News-Pictorial".  
Availability: See publication

HS-024 638

#### **THE DESIGN AND EFFECT OF CHILD RESTRAINT SYSTEMS IN VEHICLES**

According to both anatomical considerations and the results of simulated crash test studies, a rear-facing child car seat/restraint system anchored to the car, with hard, nonrecoiling paddings, and which supports the entire body surface of the child is the most effective means of protection. The child seat should be fitted to the rear passenger compartment for maximum safety, although real and simulated crashes have shown that the back of a good rearward-facing seat gives acceptable protection even in the front compartment. The excellent protective capacity of rearward-facing seats in simulated crash tests has been strengthened by statistical crash data from Sweden. Not one of the 300,000 seats sold in the country has been involved in an accident in which a child has been killed or injured (as far as is known). Since all traffic deaths in Sweden are investigated and reported carefully, this good performance record is well-verified. Results of surveys in Sweden confirm that rearward-facing seats are, for most families, practical and usable. Today, the "third generation" seats being marketed in Sweden are even easier to handle and use than the old ones in terms of their buckles, harnesses, and instructions for installation. The seats are now being made larger to accommodate children up to five and six years of age, because so many parents have found that their children like and accept the seats.

by Peter W. Arnberg  
Publ: Ergonomics v21 n9 p681-90 (Sep 1978)  
1978; 21refs  
Sponsored by National Swedish Road Safety Office, Swedish Consumer Organization, and Transport Res. Delegation.  
Includes French and German summaries.  
Availability: See publication

HS-024 639

#### **FACTORS AFFECTING THE VARIABILITY OF DRIVER GAP-ACCEPTANCE BEHAVIOUR**

Experiments have been conducted which involved repeated measurements or observations of an individual driver's gap-acceptance behavior in order to identify factors which influence both within-subject and between-subject variability. The experiments included both simulated and real-life situations and subjects ranged from students with relatively little driving experience to police drivers and members of the Inst. of Advanced Motorists. Within-subject variance could be explained in part by the speed and type of the oncoming vehicle, although the greater part of the variability in the subject's critical gap remained unexplained. Attempts to explain between-subject variance were hindered by the correlation between mean critical gap and variance of critical gap which created difficulties in the identification of factors affecting each variable. Results were not conclusive, but evidence suggests that low values of these two parameters are associated with extroversion, high engine capacity, high annual mileage and young drivers.

by C. G. Bottom; R. Ashworth  
Publ: Ergonomics v21 n9 p721-33 (Sep 1978)  
1978; 12refs  
Sponsored by Science Res. Council (U.K.). Includes French summary.  
Availability: See publication

HS-024 640

#### **HAZARDOUS MATERIALS TRANSPORTATION. ANNUAL REPORT (8TH) OF THE SECRETARY OF TRANSPORTATION ON HAZARDOUS MATERIALS CONTROL**

A summary of DOT activity in the field of hazardous material transportation regulation is presented for calendar year 1977. The report includes the year's highlights, and detailed coverage of accident and casualty reporting; technology, research and development; regulations development; compliance evaluation; training programs; a summary of outstanding problems; and recommendations for additional legislation. The administration of the hazardous materials transportation program by the Coast Guard, the Federal Aviation Administration, the Federal Hwy. Administration, the Federal Railroad Administration, and the Materials Transportation Bureau is described, as are the regulatory amendments adopted in 1977, the compliance enforcement program, and program coordination. A summary of hazardous materials incidents is provided. Appendices present a list of 924 exemptions in effect during 1977, including the purpose and reason for each, and a table of hazardous materials research and development projects and reports.

Department of Transportation, Materials Transportation Bureau, Washington, D.C. 20590  
Rept. No. DOT/RSPA/MTB-78/3; AR-8; 1978; 73p 15refs  
Rept. for 1977.  
Availability: Corporate author

HS-024 641

# **WORLDWIDE TRANSPORTATION/ENERGY DEMAND FORECAST: 1975-2000**

The methodology of this long-range transportation energy forecast is described, and a set of 34 countries is considered explicitly, including projections of population and gross domestic product (GDP). It is calculated that the U.S. will experience the lowest growth rate worldwide in the amount of energy for passenger transportation from now until the year 2000, dropping from a 51.3% of the world's total in 1975 (with 29.1% of the world's GDP) to a 30% to 32% share (a 26% to 28% of GDP). The most spectacular growth in energy for passenger transportation probably will occur among the industrialized communist economies (approximately 500%), followed by the developing countries (approximately 250%), and Japan (approximately 200%). The U.S. used only 20% of the world's total freight energy in 1975, barely ahead of Western Europe and the U.S.S.R. When adjusted for GDP, the U.S. is among the least freight energy-intensive countries in the world. By the year 2000, this favorable comparison should be even more pronounced. The advanced developing countries and the less developed countries will account for much larger proportions of freight transportation energy. The U.S. consumption of 39% of the world's total transport energy in 1975 will drop to the 21% to 23% range by the year 2000, when the U.S.S.R. and the developing countries will have the most greatly increased shares in the world's transport energy. Even for the lower of two projected growth scenarios, world demand for transportation energy will grow to 220% of that for 1975 by the year 2000, and barring unforeseen technological developments, the world will become even more dependent on liquid (petroleum-based) fuels than at present. In fact, nonpetroleum-based energy is likely to decline from 6.4%, the 1975 proportion, to 4.2%.

by Robert U. Ayres

Oak Ridge National Lab., Oak Ridge, Tenn. 37830; Delta Res. Corp., 1401 Wilson Blvd., Arlington, Va. 22209  
DOE-W-7405-ENG-26

Rept. No. ORNL/Sub-78/13536/1; 1978; 105p 28refs

Subcontracted to Delta Res. Corp., Purchase Order ORNL-11X-13536V.

Availability: NTIS \$6.50 printed copy, \$3.00 microfiche

HS-024 642

# **IDENTIFICATION OF VEHICLES (ISO WORLD- WIDE SYSTEM) TRANSMITTED BY THE INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)**

Information is outlined concerning the preparation, within the International Organization for Standardization (ISO), of a vehicle identification system, including VIN (vehicle identification number) and VMI (world manufacturer identifier) and concerning standards ISO/DIS 3779 (VIN) and ISO/DIS 3780 (WMI). The ISO's Vehicle Identification Subcommittee, ISO/TC 22/SC 20, held its first session in 1972 in Washington, D.C., at which the following initial principles were agreed upon: inclusion on the extreme left of the VIN of a section identifying the vehicle manufacturer and a section on the extreme right ensuring that no confusion with another manufacturer was possible. At its second session, held in Turin in 1973, Subcommittee 20 set a target date of Jun 1974 for completion of the study, and specified the structure of the VIN, the number of alphanumeric characters, the sphere of application, the presentation of the number, and certain defini-

tions. At the third session in Jun 1974 in Brussels, two draft standards were drawn up concerning identification of vehicles (a VIN code established, comprising the WMI, the vehicle descriptor section (VDS) with one to six alphanumeric characters, and the vehicle indicator section (VIS) comprising eight characters, the first four required to be numeric) and identification of vehicle manufacturers (a WMI code comprising three alphanumeric characters, the first designating the geographic area, the second the country concerned, and the third a specific manufacturer). In Sep 1975, the Subcommittee met in Rome to consider comments, and to establish the procedure for assigning the WMI codes. The definitive texts of ISO draft international standards 3779 and 3780 were prepared for publication after approval by the ISO Council. Since the standards' publication in Feb 1976, the structure of the VDS has been changed to six characters. In Jan 1977, ISO standard 4030, which concerns the location and attachment of the VIN, was published.

Economic Commission for Europe, Inland Transport Com. Rept. No. TRANS/SC1/WP29/R.169; GE.78-28426; 1978; 6p  
Group of Experts on the Construction of Vehicles, 56th Sess., Agenda Item 7.  
Availability: Corporate author

HS-024 643

# **ELECTRIC VEHICLES ARE 'FOR REAL'**

The plastics-intensive, battery-powered electric vehicle (EV), produced in volume quantities, may be a giant step closer to reality because of a revolutionary new battery just developed by Continental Group, Inc. The new battery can be used in conventional-sized cars and permits cruising speeds up to 100 mph and a driving range of 1000 mi before recharging. Two foreign automakers (Fiat and Datsun) reportedly will be the first users of the battery, sometime during the next several years. While industry awaits this development, EV's already represent a growth market for plastics. Industry sources anticipate an annual market for one million EV's by 1985. At an average of 600 lb per car, this would add about 250,000 tons of plastics to the automotive market, or roughly 25% of this year's (1978) tonnage. Many of the experimental EV models (e.g. Dept. of Energy's (DOE) electric commuter automobile built by the Budd Co. for The Garrett Co., General Electric Co.'s Centennial Electric, also developed under DOE's Near Term Electric Vehicle Prog., and the Copper Electric Runabout designed and built under the aegis of the Copper Devel. Assoc.) and commercial EV models (e.g. Borg-Warner's Comuta-Car and Comuta-Van, and the Yare (an egg-shaped vehicle designed by Dr. H. D. Kesling and built by TP Labs. Inc.) make heavy use of plastics to compensate for the battery weight of 1000 lb or more required by each vehicle. Plastics currently in use on commercial EV's include Borg-Warner's Cyclolac-LS ABS, and Lexan polycarbonate (used to replace window glass).

Publ: Modern Plastics v55 n11 p44-5 (Nov 1978)  
1978

Availability: See publication

HS-024 644

# THE UNSTEADY GAS FLOW BEHAVIOUR IN A CHARGE COOLED ROTARY PISTON ENGINE

Mathematical models of the open-cycle gas exchange process and the closed-cycle combustion process are developed for a Wankel engine, using basic unsteady gas flow theory. The theoretical model of the complete engine operating cycle is programmed for a digital computer, and the results are shown for a small, single-rotor, charge-cooled Wankel engine. The predicted pressure diagrams in the working chamber and in the inlet, transfer, and exhaust ducts are compared with measured values, as is the predicted volumetric efficiency relationship with engine speed. The predicted charging efficiency relationship with engine speed is also compared with the measured brake mean effective pressure characteristic to demonstrate the usefulness of the theoretical model. With a knowledge of friction losses, the program could be extended to directly predict engine performance characteristics. The model will be an invaluable design tool in the continuing development of the Wankel engine.

by G. P. Blair; R. Fleck  
Queen's Univ. of Belfast, Mechanical and Industrial Engineering Dept., Northern Ireland  
Rept. No. SAE-770763; 1977; 22p 12refs  
Presented at Off-Highway Vehicle Meeting and Exhibition, Milwaukee, 12-15 Sep 1977. Research sponsored by Mercury Marine, USA.  
Availability: SAE

HS-024 645

# DETERMINATION OF THE EFFECTIVENESS AND FEASIBILITY OF REGENERATIVE BRAKING SYSTEMS ON ELECTRIC AND OTHER AUTOMOBILES. FINAL REPORT. VOL. 2: DESIGN STUDY AND ANALYSIS

In a discussion of regenerative braking in electric and other automobiles, regenerative braking principles, definitions of relevant terms and calculational parameters, descriptions of drivetrain and energy storage technology, and a review of regenerative system types are presented. These types include electric, mechanical, hydraulic, pneumatic, and combination systems. The evolution of regenerative braking covers early history (the 1800's, and the situation by 1900), progress from 1900 to 1970 in nontechnical issues, automotive applications, railway applications, and other applications, other technology related to regenerative braking (nonregenerative retarders and dynamic braking), and developments since 1970. Case studies are presented of development and proposals for development of regenerative braking systems since the late 1960's. Electric, hybrid, combined systems, and public transit vehicles are discussed separately. Results from various recent tests yield information on the degrees of brake application commonly found in automobile operation, and the amount of energy normally dissipated by brakes. These results provide evidence of the energy available from braking, and indicate the range extension due to regenerative braking for electric vehicles operated in a stop-and-go or urban environment. Recent analytical studies include an analysis by the Lawrence Livermore Lab. of the cost and effectiveness of various candidate power systems to which regenerative braking can be applied. The candidate systems include all electric with d.c. series motor, all electric with separately-excited motor, all electric with a.c. induction motor system, flywheel/battery system

(both parallel and tandem configuration), battery/heat engine hybrid system, and internal combustion engine/hydropneumatic combined system. A review of U.S. patents relating to regenerative braking systems and components is presented, including summaries of the technical contents of each patent. Appendices provide a roster of study team members and organization, a copy of the Electric and Hybrid Vehicle Res., Devel., and Demonstration Act of 1976 (Public Law 94-413), clarification of intent of PL 94-413, Section 13e wording, and a patent search review of 126 patents on regenerative braking, concerning electrical control circuits, electromechanical systems, mechanical storage systems, and coupling to vehicle resistance.

by D. D. Davis; R. A. Renner; F. C. Younger; R. C. Epps; S. S. Lerner  
University of California, Lawrence Livermore Lab., P.O. Box 808, Livermore, Calif. 94550  
DOE-W-7405-ENG-48  
Rept. No. UCRL-52306/2; 1977; 289p 101refs  
Availability: NTIS \$9.25 printed copy, \$3.00 microfiche

HS-024 646

# CAN WE FORCE 55 [TRUCKS, SPEED-LIMITING DEVICES]

A movement for mechanical limitation of the top speed of on-highway vehicles is rapidly gaining momentum in the trucking industry. Proponents of new speed-limiting devices say that these systems may be the last resort for fleet operators in attempts to make drivers comply with the 55 mph speed limit. Many fleet operators believe that a device is needed to put a ceiling on top vehicle road speed while giving the engine full power in lower gears to climb hills and move through traffic with heavy loads. Such a device also must be tamper-proof or tamper-resistant. Recently, a special American Trucking Assoc. Technical Advisory Group (TAG) task force was created to promote the development of speed-limiting and fuel-management control. According to early reports, the task force is looking for a system that will sense road speed and shut off the fuel supply when a preset speed limit is reached. Aware that the concept of speed limiting raises serious questions about safety, consideration will be given to an override feature that could be utilized in emergencies, should the driver need an extra burst of speed to avoid trouble or pass another vehicle. Strong opposition is already being voiced by the International Brotherhood of Teamsters, and the Professional Drivers Council. Both sides are apprehensive about premature government intervention. The Federal Hwy. Administration and the Bureau of Motor Carrier Safety report that no regulatory action in the speed-control field is planned at this time. The Sturdy Truck Equipment Mfg. Co. and Lenmar Industries each claim to have a road-speed limiter, not an engine governor, that will stop driver speeding, give full power in lower gears, and resist tampering. The first company's device is now on the market, the second system is presently being road tested. The Sturdy Road Speed Control works simply by positioning the throttle arm on the fuel pump. The Lenmar vehicle speed limiter counts the revolutions of the speedometer cable to control supply of fuel.

by Thomas W. Duncan  
Publ: Fleet Owner v73 n4 p78-82 (Apr 1978)  
1978; 2refs  
Availability: See publication

HS-024 647

HSL 79-07

HS-024 647

# **SUGGESTIONS TO HELP DEALERS RESPOND TO CUSTOMERS' CONCERN FOR TIRE SAFETY**

Various items of information are presented which may be useful to independent tire dealers in providing tire safety and use tips to their customers. The National Tire Dealers and Retreaders Assoc. invites the submission of ideas for a special approach to promote tire safety to the "NTDRA Dealer News" for sharing with dealers across the country. Other organizations involved with tire safety include the Tire Retread Information Bureau and the Tire Industry Safety Council. It is pointed out that proper air pressure is the most important element in good and safe tire care. A diagrammatic representation of a tire in various stages of inflation is presented. NTDRA suggestions for proper tire use include the following: carry your own air pressure gauge; be sure that you have enough air in the spare tire in your trunk; to prevent misalignment of wheels, do not brake at the precise moment a wheel strikes a pothole on the road; store your summer tires away from the furnace and electric motors; store tires flat and keep them out of sunlight; do not drive year round on snow tires; check for balding tires by sticking a penny into the tire's tread, Lincoln head first, and see if all of the top of Lincoln's head is visible (if so, tire is bald); and check sidewall of tires for specific data, such as maximum inflation suggested for tire. The National Hwy. Traffic Safety Administration is contacting major tire companies in the hope that they will resist efforts by service stations to charge customers for the use of air. This charge, it is felt, would discourage proper tire inflation. Several tire companies are cited as having already taken steps toward tire safety for consumers. Armstrong Tire and Rubber Co. is investigating portable air compressors which could be offered to the public at a reasonable price. BFGoodrich is offering motorists free tire inspections on all brands of tires at or in cooperation with the company's independent dealers and tire centers in selected "test" communities. A BFG Tire Safety Campaign will include a free brochure on tire safety and care, a free mobile tire safety inspection program to be conducted by Tire Safety Teams at shopping centers and other areas, a localized publicity campaign, Tire Safety Team inspection of tires on public vehicles, an educational film or slide show aimed at driver education programs, and talks to groups and on radio and TV.

Publ: NTDRA Dealer News v41 n20 p6, 19 (13 Nov 1978)  
1978

Availability: See publication

HS-024 648

# **SEASONAL VARIATIONS IN PAVEMENT SKID RESISTANCE--ARE THESE REAL?**

Skid test data from various sources have confirmed that the variability in pavement skid testing has a mean standard deviation of 2 SN (skid number) or better. Using this estimate and assuming that pavement skid resistance, as measured by mean SN's, is normally distributed, the following conclusions are drawn: 98% of the test results for any given pavement should be within plus/minus 5 SN (plus/minus 2.5 standard deviations) of the mean SN; up to 2% of the test data may, by pure chance, fall outside of this 10 SN band; there is small likelihood that lack of precision may cause skid resistance variations larger than 10 SN; and seasonal skid resistance changes of any magnitude cannot be explained by chance

alone. If they could, variations would be manifested by increases for approximately 50% of the pavements and by decreases over the same period for the remaining pavements. There can be no doubt that systematic, large changes in skid resistance are real and are related to changing conditions. Lack of precision in skid testing may obscure the results by making the changes appear either larger or smaller than they really are. For this reason it is important to keep the skid test system in top condition. For monitoring system performance, a continuous record of the system variability is recommended. Increasing standard deviations are clear indicators of skid test system problems that need corrective action. The major sources of error in skid resistance testing (in decreasing order of magnitude) include calibration errors, lateral position, chart evaluation, water nozzle and test tire, zero shift in the instrumentation, and temperature during testing.

by Rudolph R. Hegmon

Publ: Public Roads v42 n2 p55-62 (Sep 1978)

1978; 17refs

Availability: See publication

HS-024 649

# **RESEARCH TECHNIQUE FOR THERMAL STABILITY BY MODIFIED JET FUEL THERMAL OXIDATION TEST (JFTOT)**

A laboratory technique was developed for producing oxidation deposits by incorporating a bulk heating step into the ASTM (American Society for Testing and Materials) D 3241 Jet Fuel Thermal Oxidation Test (JFTOT) procedure. The bulk heating step is provided by a stirred integral heated reservoir installed between the fuel supply tank and the test section. This modification allows detection of reactive species which are not sensed when fuel is tested for thermal stability by the D 3241 procedure or by the ASTM D 1660 Fuel Coker procedure. One example of such a reactive species is a disulfide typical of that produced in a mercaptan oxidation process. In rig tests which simulate supersonic aircraft fuel system environments, some fuels finished by mercaptan oxidation processes have been shown to produce excessive heat exchanger and filter deposits. The modified JFTOT procedure (CRC (Coordinating Res. Council) Designation E-21-78) also can be operated under low pressure conditions to duplicate the pass/fail conditions of the CRC Research Coker which is used to test the thermal stability of advanced military supersonic JP-7 fuel. However, at JP-7 test temperatures, low pressure operation results in two-phase flow in both the modified JFTOT and the Research Coker. A reassessment of the Research Coker's correlation with full-scale rigs is needed, since the latter do not operate in a two-phase mode. Of the alternatives studied to provide bulk heating, the system described above is the simplest to install and operate since it can use the same power supply as the standard D 3241 apparatus. Called the Mini Heated Reservoir, it assures close control over surface metal temperature and residence time for bulk heating of fuels; stirring keeps oxidation deposits in suspension to be sensed by the standard D 3241 procedure.

Coordinating Res. Council, Inc., JFTOT Evaluation Panel, 30 Rockefeller Plaza, New York, N.Y. 10020

Rept. No. CRC-496; 1978; 69p 7refs

Availability: Corporate author



HS-024 650

## 1977 CRC [COORDINATING RESEARCH COUNCIL] OCTANE NUMBER REQUIREMENT SURVEY

In the 21st annual statistical survey of current model vehicles conducted by the Coordinating Research Council, Inc., test data were obtained on 478 1977 model vehicles including 12 select models of special interest. Motor octane number (MON) and research octane number (RON) requirements under full- and part-throttle operating conditions were determined, and surface ignition knock and rumble, if present, were also reported. For the first time, noncommercial vans and light-duty trucks (1/2-3/4 ton without four-wheel drive) were weighted for sales and tested as part of the total U.S. population because of the significant and increasing volume of these vehicles being sold and used instead of passenger cars. Beginning this year, the term "car" designates passenger cars only, while "vehicle" includes passenger cars plus vans and light-duty trucks. The vehicles used in this program had an average of 9141 deposit miles. Analyses are included for U.S. and imported vehicles (i.e. total cars plus vans and light-duty trucks), U.S. cars, U.S. vehicles, and U.S. and imported cars. The speed for maximum knock occurred between 1600 rpm and 2800 rpm for 87% of all U.S. and imported vehicles with primary reference (PR) fuels, 67% with average-sensitivity full-boiling range unleaded (FBRU) fuels, and 65% with unleaded high-sensitivity full-boiling range (FBRSU) fuels. Incidence of part-throttle knock equal to or greater than full-throttle knock was lower in 1977 than in 1976. Maximum requirements occurred at part throttle in 1.9% of all 1977 vehicles with PR fuels, 13.2% with FBRU fuels, and 14.8% with FBRSU fuels. In the 1977 survey, 44% of the weighted vehicle population was found to knock on tank fuel compared to 47% in the 1976 survey; there were 14 reports of after-run on tank fuel. There were four reports of passenger cars with surface ignition knock vs. three in 1976. Road octane number depreciation of FBRU fuels in the range 86 RON to 100 RON varied from 2.0 to 5.2 compared to 1.5 to 4.4 in 1976. Depreciation of FBRSU fuels in the range 89 RON to 101 RON varied from 3.2 to 6.8 compared to 3.0 to 6.0 last year. Octane number requirements were determined over the speed range in 413 U.S. and imported vehicles using PR fuels; maximum requirements at each satisfaction level occurred between 2000 rpm and 2150 rpm; a spread of 5 to 6 octane numbers existed across the speed range between the highest and lowest requirements at all satisfaction levels. Maximum requirements with FBRU fuels were observed in highest gear with 65% of vehicles, in passing gear with 33%, and were the same in both gears with 1%. The remaining 1% of the requirements were greater than the highest FBRU fuel available.

Coordinating Res. Council, Inc., CRC-Octane Number Requirement Survey Group, 30 Rockefeller Plaza, New York, N.Y. 10020  
Rept. No. CRC-497; 1978; 306p  
Availability: Corporate author

HS-024 654

## SKID RESISTANCE PROGRAM YIELDS TANGIBLE AND INTANGIBLE SAVINGS

Because of the incidence of wet-weather accidents and potential for fatal accidents involving slippery pavements, a comprehensive study was authorized by the Board of Supervisors and undertaken by the Los Angeles County Road Dept. to determine skid resistance characteristics of typical pavement

surfaces under jurisdiction of the Board. The ongoing program consists primarily of periodic skid testing and evaluation of accident records. Portland cement concrete (PCC) pavement was found generally to show a reduction of skid resistance with increasing age, primarily at intersections subject to heavy traffic. A major finding indicates that traffic volume is the most significant factor in reduction of initial skid resistance, due to a combination of polishing and oil film deposit on the surface which degrades skid resistance, as a direct result of high traffic volumes. PCC bridge decks were also found to degrade in skid resistance with increased age and traffic volume; skid resistance in these locations was generally determined to be adequate, based on the higher initial skid resistance number (SN) obtained by the finishing techniques used in bridge construction (transverse brooming). Tests on asphalt concrete pavement gave comparable results to PCC bridge decks. Rock and oil chip seal surfaces showed good SN's except where bleeding was experienced, usually with heavy traffic. Slurry seal road surfaces had a test record similar to rock and oil chip. Fog-sealed asphalt concrete had generally good SN's. A key element in the study indicated that skid test data alone should not be used in deciding on corrective action. Texturing by grinding is now the primary method for improving skid resistance on PCC pavement, especially on critical traffic locations with high volumes. Grooving also has been used. Analysis of locations in the county where grooving and texturing have been completed shows that none have a high wet-pavement accident incidence and, as expected, most have substantially lower accident rates than before the work was done. Resurfacing of asphalt concrete pavements, application of slurry seal on older pavements, and epoxy-bonding seal for portland cement and asphalt concrete are also used for improving skid resistance.

by I. L. Morhar  
Publ: Public Works v109 n1 p36-9 (Jan 1978)  
1978; 1ref  
Availability: See publication

HS-024 655

## CAN GAS GUZZLERS LEARN TO SIP?

Instead of basing new car designs on existing cars which now meet or exceed the 1985 fuel economy requirement (27.5 mpg), the U.S. auto industry is opting for new technology which will reduce fuel consumption with fewer compromises on the size and style of cars to which Americans are accustomed. The single most important strategy will be to reduce weight; a 1% weight reduction can yield 0.17 to 0.75 greater fuel efficiency, depending on other possible modifications. Reducing the weight of a car body results in less weight in suspension components and frame, as well as in brakes and engine. Ford is developing a full-size prototype sedan 30% lighter than Ford's current (1979) production cars, with body and frame of graphite-epoxy composites and aluminum. The fuel economy of this vehicle is expected to be increased by 30%. Fuel consumption also depends on engine and drivetrain efficiency, rolling resistance, and aerodynamic drag; improvements in these areas are on Detroit's current agenda. Greater engine output, permitting smaller displacements and concomitant decreased fuel consumption, could be achieved by raising compression ratios, reducing engine and drivetrain friction, and recovering energy from exhaust gases. The first of these options is constrained by antipollution systems and the octane rating of available gasoline; the second is difficult to achieve because engine and drivetrain friction is already quite low; the



third promises sizeable gain in output, but requires some fairly complicated equipment. Reduced rolling resistance depends mainly on tires; today's radial tires have 20% less rolling resistance than bias ply tires, and one newly-developed radial tire for light trucks will do even better. Another development is an easy-rolling elliptical radial that meets industry's standards of ride quality when inflated to 50 lb/sq in. Aerodynamic drag reduction is a matter of compromise between passenger comfort and streamlining. To reduce drag, designers will minimize turbulence-causing protuberances such as headlights, bumpers, mirrors, and door handles, and reduce frontal area by using sloping hoods and windshields, commensurate with visibility requirements.

Publ: Technology Review v80 n6 p18-9 (May 1978)  
1978; 1ref  
At head of title: Trend of Affairs--Transportation.  
Availability: See publication

HS-024 656

# **AUTOMOTIVE SAFETY FOUNDATION RESEARCH REPORT (DEPARTMENT OF TRANSPORTATION AUXILIARY OFFICE) [HEAD IMPACT STUDIES, MONKEYS]**

Subject-restraint equipment was developed and employed in a series of experiments to study the effects of frontal impacts on the head, using 40 live monkeys as subjects. The objective was to isolate the effects of impact and rotation on a subject's head (excluding the neck). The test equipment is described in detail. Results of pathological, neurological, and physiological examinations are presented, with deductions concerning the extent of brain damage as a result of the impacts. Head impact acceleration and head rotation angular velocity measurements are provided. Lasting impact effects were observed on 18 monkeys. Among the conclusions drawn from the study were that cerebral contusions (other than concussions) were attributable to the severity of rotation rather than to forward impact; and that relatively low impact velocities caused concussions accompanied by respiratory stoppage. Severe concussions often developed slowly and resulted in permanent brain damage. Respiration recovery was the critical factor in survival of the victim, indicating the importance of emergency oxygen and resuscitation.

Japanese Automobile Lab.  
1978; 89p 2refs  
Translated from Japanese (original 40p; translation 49p).  
Availability: Reference copy only

HS-024 657

# **IMPORTANT DATA FOR LATERAL VEHICLE DYNAMICS (WICHTIGE DATEN FÜR DIE KURSHALTUNG VON KRAFTFAHRZEUGEN)**

An analysis is presented of frequency responses in the driver-vehicle system in which the input is the steering wheel angle, and the outputs are yaw velocity, sideslip angle, lateral acceleration, and steering wheel torque. The critical range for vehicle frequency responses, between 0 Hz and approximately 0.5 Hz, is examined. Velocity is kept constant. It is demonstrated that in addition to vehicle velocity, the following six vehicle engineering values are of importance in characterizing lateral vehicle dynamics with respect to driver-vehicle performance: vehicle size, center of gravity, steering sensitivity,

cornering stiffness of tires (and axles) relative to wheel load, ratio of cornering stiffness torques, and a value proportional to the steering wheel torque.

by Manfred Mitschke  
Publ: ATZ Automobiltechnische Zeitschrift v80 n6 p263-70 (1978)  
1978; 20p 7refs  
Translated from German (original 6p; translation 14p).  
Availability: Reference copy only

HS-024 658

# **TO A GLOBAL CAR [STANDARDIZED AUTOMOBILES, INTERNATIONALISM]**

Due to unprecedented market upheavals accompanying costlier fuel and shifting exchange rates, national differences in car design and styling are being narrowed, fostering cross-border supply of components and a marked trend toward "world cars" (i.e. standardized autos designed to be built and sold in any major market with few changes). The distinction between domestic and foreign production is being blurred as automakers integrate and streamline their global operations, especially in Europe. Creation of the Common Market has slashed trade barriers among member countries and enabled automakers to reduce costs by integrating their European operations more completely. Ford Motor Co. led the way, and the European companies are catching up quickly. Japanese cars presently have 5.5% of the European market (up from 0.6% in 1970), accelerating the pace of integration. The shift to more coordinated international operations is increasing as European automakers prepare for American companies to join the race to win world markets with small, standardized automobiles. Until recently, Detroit has regarded the products of its affiliates overseas as almost as "foreign" as those produced by non-U.S. companies. European competitors worry that by early 1980's, U.S. auto companies will be making large inroads in the overseas market through their subsidiaries in Europe and via direct exports of "internationally sized" models. Among the European automobile manufacturers competing with the U.S. in world expansion are Volkswagen and Peugeot. The popularity of Japanese cars abroad is creating problems in overall trade imbalance, which may be alleviated by exportation of foreign cars into Japan, or by assembling Japanese cars abroad. South Korea is emerging as supplier of the least expensive cars, particularly to the less developed countries. Among the obstacles hindering internationalism in automobile manufacture are local content requirements that hinder outside sourcing. Another barrier to U.S. expansion is the enormous retooling cost of downsizing automobiles to meet fuel economy requirements.

Publ: Business Week n2561 p102-5, 108, 110, 113 (20 Nov 1978)  
1978  
Availability: See publication

HS-024 659

# **PERSONALITY FACTORS IN ACCIDENT CAUSATION**

The literature is reviewed concerning the association of personality traits and traffic accidents. In general, aggression seems to be a critical link between alcoholism, depression, patterns of reaction to stress, the theory of the accident

process, suicide, and accidents. Research in this area often has been criticized, and countermeasure development to deal with complex psychological processes is a difficult task. Rather than view an accident as an isolated event, researchers now propose that accidents are preceded by a number of often recognizable signs which indicate stress, anxiety, and conflict. Preaccident behavior (studied in an industrial setting) has been shown to include making simple mistakes usually not made, breaking safety rules usually not broken, committing several safety infractions (in a series) during a short time period, and predicting one's own injury. Suicide has also been linked to accident statistics, with depression, alcoholism, aggression, suicide and accidents linked as resulting from earlier patterns of development associated with inadequate parenting and conflicts with authority. It may be possible to develop intervention strategies which short circuit the accident process. Research in industry suggests that the attitude of supervisors toward workers and supervisor knowledge of workers' personalities and capacities are critical to safety. Though some support educational interventions, other experts in the field believe that better design of the road-use environment, taking into account "human frailty", is the more productive route to accident reduction.

by Deborah Valentine; Martha Williams; Robert K. Young  
University of Texas at Austin, Center for Advanced  
Transportation Studies, Austin, Tex. 78712  
(77)-7200-02-B  
Rept. No. CATS-RR-48; 1977; 64p 236refs  
Sponsored by Texas Office of Traffic Safety.  
Availability: Corporate author

HS-024 660

#### **APPLICATIONS OF INTERACTIVE GRAPHICS [TRANSPORTATION STUDIES]**

Four papers on transportation research using an interactive graphic system between person and computer are presented: an interactive graphic sketch-planning model for urban transportation, the Volvo approach to computer-aided transportation planning, computer-animated simulation of taxi-dispatching strategies, and computer graphics human-figure system applicable to transportation.

by Mary McLaughlin, ed.  
Transportation Res. Board, 2101 Constitution Ave., N.W.,  
Washington, D.C. 20418  
Rept. No. TRR-657; 1977; 29p 15refs  
Includes HS-024 661.  
Availability: TRB \$3.00

HS-024 661

#### **COMPUTER GRAPHICS HUMAN-FIGURE SYSTEM APPLICABLE TO TRANSPORTATION**

A research effort to develop an improved computer graphics system for representation of the human figure that has usefulness for transportation research is discussed. Applications that parallel the transportation design process in the variety of levels of detail required are emphasized. To achieve a number of levels of detail, a system of several data subbases, each of which increases by one order of magnitude in number of points, is under development. For example, a human figure represented by a single point can be useful in overview plots of population density and consumer areas. A crude 10-point figure can be applied to studies of queuing theory and the

simulated movement of groups. A 100-point figure can be animated to scale in a design showing different overall body shapes, including male and female figures. A 1000-point figure, similarly animated, can be used in anthropometrics for workstation designs, gross body movements, and occupant motion in vehicle crashes. Extrapolations of this order-of-magnitude approach ultimately should result in very complex data bases and a program that automatically selects the correct level of detail. Demonstrations of potential applications of this system to date have included a seated figure, representation of figure scales in a monorail design simulation, and a motion simulation of a skeletal hand.

by William A. Fetter  
Southern Illinois Univ.  
Publ: HS-024 660 (TRR-657), "Applications of Interactive Graphics," Washington, D.C., 1977 p20-3  
1977; 6refs  
Sponsored by National Science Foundation.  
Availability: In HS-024 660

HS-024 662

#### **FROM THE BEGINNING SAFETY WAS THE GOAL [COMMERCIAL VEHICLE INDUSTRY, SAFETY PROGRESS DURING THE PAST 50 YEARS]**

Truck and bus industry safety progress during the past 50 years or so has paralleled regulation, principally Federal regulation resulting from and subsequent to the 1935 enactment of the Motor Carrier Act. The major purpose of the Act was to establish economic stability in the rapidly growing transportation industry; safety was incidental. Regulation of the motor carrier industry was entrusted to the Interstate Commerce Commission (ICC), and in 1940, the ICC really began exercising its safety authority. In addition to driver qualifications and hours of service permitted, legal rulings encompassed the safety of operation and equipment of motor carriers as well as proper reporting of accidents. The rules applied to common and contract carriers at the outset, and eventually included private carriers. Hazardous loads came under much closer scrutiny as carrying of munitions and other types of explosives by truck became commonplace. Flammable liquids, compressed gases, poisons, and acids were subject to jurisdiction derived from the Transportation of Explosives Act, which originally related to railroads. As the complexities of regulating hazardous-materials transportation grew, the size of the safety inspector staff failed to keep pace. Nevertheless, more stringent rules were put into effect and better methods of stimulating carrier compliance were found. During the 1950's, a series of downhill runaway accidents revealed that certain brake components sometimes were being neglected by fleets engaged in hazardous-materials transport. Industry and government cooperated to make mandatory brake protection devices on tractors, as well as means of emergency activation of trailer brakes on all hazardous-materials rigs. During the 1960's, lighting regulations and hours of service were revised. Drastically strengthened specifications for the type of steel used in cargo tanks, and in their design and fabrication, were adopted. In spite of all precautions, the hazardous-hauling problem is far from solved. Management, labor, and government are all aware that reliable data must be assembled to determine where

progress has been made in highway safety, and what directions to take next.

by Ernest G. Cox  
 Publ: Fleet Owner (Anniversary Issue 1928-1978) p119-21  
 (Mid-Oct 1978)  
 1978; 2refs  
 Availability: See publication

HS-024 663

## DIESEL FOUR WHEELERS: CAN WE TAKE THE RAP FOR FUEL ECONOMY?

U.S. automakers are cautiously introducing the diesel engine as an option on their automobiles and pickup trucks as one strategy to meet the 1985 fuel economy (27.5 mpg) standard and requirements for extremely low emissions of carbon monoxide, hydrocarbons, and nitrogen oxides. The diesel engines are very economical, using about 25% less fuel than gasoline engines of the same power. Because diesel engines use fuel injection rather than carburetion and ignite their fuel solely from the heat produced by compression, tune-up is virtually unnecessary and periodic maintenance consists only of cleaning and adjusting the fuel injection system and changing oil and oil filter regularly. Diesel engines tend to last longer than gasoline engines, and those in the new cars and light vehicles are acceptably quiet from the interior of the vehicles. Although diesel emissions have a peculiar sour smell, they are free of lead and do not include significant amounts of carbon monoxide. There are many inherent characteristics of the diesel engine which may be unacceptable to the American consumer, although time and effort may cure some of the ills. Disadvantages of the engine include less rapid acceleration, longer time to reach cruising speeds, mechanical noise ("diesel rap"), the need for special devices for running power brake units and accessories, exhaust nitrogen oxides and hydrocarbons which result in photochemical smog when exposed to sunlight, and starting difficulty in cold weather. It may also be difficult to find mechanics who can work on diesels, and service stations supplied with diesel fuel.

Publ: Technology Review v80 n6 p16-8 (May 1978)  
 1978  
 At head of title: Trend of Affairs--Transportation.  
 Availability: See publication

HS-024 664

## NEW ELASTOMERS TAKE TO CARS AND ABUSE

Recent government mandates on bumper impact requirements have created totally new applications for elastomers in automotive designs, and more than a dozen new types or grades of elastomers applicable to the harsh automotive environment have been introduced in the past two years. Cars may now have elastomeric-faced bumpers, or entire elastomeric or flexible fronts and rears instead of bumpers. Conventional bumpers are still the most common, but they now protrude from body lines and are designed to absorb minor impact. Covering the shock-absorbing mechanisms behind the bumpers are sight shields, elastomeric sheets which will deflect on impact and pop back to their original position once impact loads are removed. Fender extensions or close-out panels which also must give on impact are elastomeric. Most of these applications are of reaction injection molded (RIM) urethanes, injection moldable thermoplastic polyurethanes and olefins, and in-

jection moldable, thermoplastic, ethylene propylene diene monomer (EPDM). RIM urethanes are used on fronts, rears or bumper fascia. Thermoplastic urethanes, olefins, and EPDM are commonly used for sight shields, soft fender extensions, and other filler panels, although polyvinyl chloride and thermosetting EPDM also have been used. Room temperature vulcanizing silicone is finding greater use for formed-in-place gaskets, although the acrylate acid diester anaerobics are also replacing conventional pre-cut gaskets. New types of elastomers have been developed over the past several years to enhance the versatility of this major family of materials and include polyester urethanes, thermoplastic olefins, polycaprolactone and polyester-based thermoplastic urethanes elastomers with high loadings of ethylene vinyl acetate "elastomeric-oriented" copolyesters, fluoroelastomers, and cellular-foam carboxylated elastomers. New fluoroelastomers are chemical and solvent resistant, and in some cases steam resistant, for application to various seals, hoses and molded products. Cellular foam carboxylated elastomers are used for interliners in seat cushions, making them more flame retardant. The latest of the new elastomers, polynorbornene, provides flexibility, abrasion resistance and damping capacity, for application to motor mounts, bumper pads, and various gaskets and seals.

by John A. Vaccari  
 Publ: Product Engineering p411-3 (Mar 1978)  
 1978  
 At head of title: Design engineering feature.  
 Availability: See publication

HS-024 665

## ALUMINUM AND TITANIUM: INNOVATIONS WITH TWO LIGHTWEIGHTS [AUTOMOBILES AND AIRCRAFT]

Although new aluminum alloys for traditional aircraft applications continue to be developed, most are being used by automakers to reduce automobile body weight. Titanium, another light metal, which also has been used by the aerospace industry, is benefitting from Air Force sponsored research relative to the reduction of parts cost. Among the new aluminum alloys in competition with mild steel and high strength, low alloy steels are wrought grades of the 2000, 5000, and 7000 series. Among the widely used are 2036 (hoods, wagon cargo decks, load floors, deck or trunk lids), 5182 (hood, deck lid and load floor reinforcements, radiator supports, and air cleaner housings), 7016 and 7029 (extruded bumper face bars), and 704 (bumper reinforcements). Impressive weight savings have been achieved in the past two years from greater use of aluminum castings in formerly traditional cast-iron components such as intake manifolds, master brake cylinder housings, power steering gear and pump housings, and to some extent brake drum. These applications make use of well-established alloys such as 308, 319, 355, 356, and 380. New aluminum sheet alloys are being introduced as well, strengthened by cold working and low temperature aging. Aluminum is also in contention for greater use in automobile wheels which, like body sheet, are still largely made of steel. Several important new alloys have also been introduced for aircraft, the emphasis being on high strength grades with improved fracture toughness, stress corrosion resistance, and fatigue resistance or combination thereof. Novel manufacturing processes such as isothermal forging, hot isostatic pressing, superplastic forming, and diffusion bonding promise substantial reductions in the cost of manufacturing titanium parts, according to the Air Force.

July 31, 1979

HS-024 668

Materials Lab. A new titanium alloy is considerably tougher than the most well-established titanium aerospace alloy.

by John A. Vaccari

Publ: Product Engineering p47-9 (Mar 1978)  
1978

At head of title: Design engineering feature.

Availability: See publication

HS-024 666

### **MOBILE TELEPHONE CONTROL UNIT DESIGN GUIDELINES FOR THE ADVANCED MOBILE PHONE SERVICE**

Mobile telephone control unit design guidelines for the Advanced Mobile Phone Service (AMPS) are presented, and application of these guidelines is illustrated by reviewing various control unit design approaches. The guidelines address two areas not encountered in land-line telephone operations. The vehicular nature of this telephone service requires that the control unit be designed to have negligible effect on driving behavior, satisfy the preferences of potential users for small, unobtrusive units that are easy to use while driving, and conform to the automobile's environmental constraints. The AMPS signaling plan uses preorigination dialing to reduce the holding time for the radio channel. To place a call, the user dials the number into a storage register in the mobile unit. The number is held in the register until the user presses a function key to release it, thus initiating a call attempt. With preorigination dialing, call-setup functions which are normally performed in the switching office are incorporated in the mobile unit where they are controlled by the user. Automobile environment constraints include mounting constraints, and temperature, illumination, and noise levels. Calling procedure considerations require storing dialed numbers, clearing prior numbers and dialing errors, initiating calls, answering and terminating calls, and status indicators. To illustrate the variety of possible control unit design approaches, the following five control unit models are reviewed: one-piece control unit, dial-in-handset control unit, separate dial pad, self-storing dial pad, and visor control unit. A limited amount of feedback on these designs has been obtained by interviewing potential customers after they had examined model units installed in cars. The units were found to satisfy many of the service needs of potential AMPS users, but were lacking in some desirable features, primarily associated with the driving environment. Integrating the control unit into the sun visor is not satisfactory for some potential users. One-piece control units appear to be more acceptable but are difficult to mount near the driver without blocking access to some part of the instrument panel. The mounting flexibility inherent in the separate dial pad approach appears to be a good solution for the changing automobile environment.

by J. Thomas Walker

Publ: IEEE Transactions on Vehicular Technology vVT-27 n4  
p276-81 (Nov 1978)

1978; 3refs

Presented at 28th IEEE Vehicular Technology Conference,  
Denver, 22-24 Mar 1978.

Availability: See publication

HS-024 667

### **A STUDY OF THE EFFECTS OF MOBILE TELEPHONE USE AND CONTROL UNIT DESIGN ON DRIVING PERFORMANCE**

A methodology for studying the effects of operating a mobile telephone on driving a car and for designing a telephone to minimize these effects is summarized. The results of a study comparing the effects of dialing a telephone to the effects of adjusting the car radio are presented as are the detailed results of a study of the effects of alternative telephone control unit designs on driving performance. Rate of head movement, duration of longest head movement, lane position, rate of steering reversals, range of speed, rate of brake application, reaction time, and dialing time were measured while subjects drove and originated phone calls using one of three types of telephone dials (rotary dial, separate pushbutton dial pad, and pushbutton dial-in-handset (to be used either with the user holding the handset or not)). Mounting locations for the separate pushbutton dial were on the dashboard, in the dashboard, or in the visor area. The rotary dial and the dial-in-handset models were mounted on the transmission tunnel. Performance measures indicate that the design of the telephone set did not have a great impact on driver control of the automobile. Subjective results indicate that drivers are concerned that the dialing task may interfere with the driving task. User preferences favored a separate pushbutton dial pad mounted in the dashboard area. Users also indicated that the hand-held dial design is awkward to manipulate while driving.

by Audrey J. Kames

Publ: IEEE Transactions on Vehicular Technology vVT-27 n4  
p282-7 (Nov 1978)

1978

Presented at 28th IEEE Vehicular Technology Conference,  
Denver, 22-24 Mar 1978.

Availability: See publication

HS-024 668

### **QUALIFYING EXOTICS. HOW TO SATISFY UNCLE SAM [EUROPEAN CARS, CONFORMANCE WITH U.S. REGULATIONS]**

A description is presented of the step-by-step procedures that must be undertaken from the time an owner buys an exotic European car abroad for import into the U.S. until it is certified by the National Hwy. Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) as conforming to their rules and regulations. The information was provided by Automotive Compliance Inc. (ACI), one of the pioneering firms in the qualification of exotic cars. The first step is to hire a broker to arrange the exit papers and clear the car through customs in whatever country it is being shipped from, by air or surface shipment. When the car has reached the U.S., a customs broker must be hired, and a customs bond posted which guarantees that the individual importing the car will bring it into compliance with U.S. regulations within 90 days or will re-export the car. Customs will release the car when the freight bill is paid and the import duty is collected. Forms must be submitted to NHTSA and EPA declaring the intention of bringing the car into compliance, how this is to be accomplished, and when it will be completed. A single trip permit must be obtained from the state highway patrol or department of motor vehicles in order to drive the car to a qualifying company, or the car must be transported. For a fee ranging from \$3500 for an older car (prior to bumper and emission

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standards) to as much as \$17,000 to \$20,000 for a Countach or Ferrari Boxer, ACI will legalize the car. After dynamometer testing has proved the car's engine to be normal, the car is then accepted for work. Since all work to bring the car into compliance must be documented for NHTSA, photographs are taken of each step in the process, and these are supplied to the government with plans and drawings when the car is completed. The most complex and difficult portion of the qualification concerns exhaust emission controls. As the emission control work (e.g. adding air pump, thermal reactor, catalytic converter) progresses, the car is tested on ACI's dynamometer to ensure that it is within tolerable limits for the official test. Evaporative and exhaust emission tests are run by an emission lab accredited by EPA. When the car has been certified by the lab, ACI completes the project by sending all of the compliance work documentation to NHTSA and EPA and obtains letters of release from both agencies.

by Thos L. Bryant  
Publ: Road and Track v30 n4 p43, 46 (Dec 1978)  
1978; 6refs  
Availability: See publication

HS-024 669

### THERMOPLASTIC NATURAL RUBBER BLEND SHOWS COMMERCIAL POTENTIAL

Researchers at the Malaysian Rubber Producers' Res. Assoc. (MRPRA) have long been seeking a means of producing a thermoplastic material from natural rubber; one method has proved successful enough to interest manufacturers, while other methods, in a less advanced stage of development, also show considerable promise. The thermoplastic rubber is obtained by blending natural rubber with crystalline polyolefins such as polyethylene and polypropylene. The blends now available are capable of being injection molded to give products with a wide range of stiffness, this and other properties being controlled by the relative proportions and type of polyolefin used. Incorporation of small quantities of carbon black into the blends enables them to be electrostatically painted, suggesting potential applications as lightweight body panels for motor vehicles. The rubber can be prepared as free-flowing granules, to assist in handling and mixing. Fundamental work on the chemical modification of the natural rubber molecule has continued by MRPRA. Research into the basic viscoelastic properties of unvulcanized rubber has been initiated to establish a better understanding of behavior during factory processing. In tire physics, the fundamental study of friction and adhesion behavior is continuing, assisted by the development of a novel apparatus to measure the adhesion between rubber and metal surfaces at varying speeds. Technical work is continuing in support of the urethane vulcanization systems now marketed under the trade name "Novor." New areas of application are being examined for another chemical development, the silane coupling agent, e.g. bonding rubber directly to glass. Development of natural rubber bearings for earthquake protection is progressing. More conventional aspects of natural rubber technology are also being studied including the testing of various rubber-to-metal bonds, and studies concerning adhesives.

Publ: Rubber Developments v31 n3 p54-6 (1978)  
1978; 1ref  
Reported in 40th Annual Report, Malaysian Rubber Producers' Res. Assoc., Jun 1978.  
Availability: See publication

HSL 79-07

HS-024 670

### MOTORCYCLE HELMETS...WHO NEEDS THEM?

Information is supplied to demonstrate to the motorcyclist the effectiveness of wearing safety helmets in preventing head injuries. The contents of the booklet have been endorsed by the National Advisory Com. on Motorcycle Safety of the Canada Safety Council and by the Legislative Com. and Board of Directors of the Motorcycle and Moped Industry Council. Separate sections discuss head injury mechanisms (brain injury, skull injury, injury prevention), helmet design (including section view of helmet), helmet standards (Canadian Standards Assoc. Standard D230, in particular), and accident statistics (including a graph of annual reported accidents per 100 registered motorcycles in a Canadian province without helmet legislation and for each of two provinces with helmet legislation during the period 1970-1975; and a graph of annual number of head-injury fatalities per 10,000 registered motorcycles for the same provinces during the period 1970-1974). Other sections report arguments presented against the use of helmets (the argument, the facts, conclusion), and brief descriptions of nine motorcycle accidents extracted from the files of the Motorcycle Crash Investigation Unit at the Univ. of Ottawa. Cases were chosen on basis of confirmed head impact, degree of representation of typical accidents and cases considered "success stories" because use of helmet prevented more serious injury. One case is presented for comparison, involving a motorcyclist who wore a helmet but did not have the strap fastened and who sustained severe permanent brain damage as the result of the accident because his helmet came off at impact.

by James A. Newman  
Biokinetics and Associates Ltd., Ottawa, Ont., Canada  
Rept. No. TP1138; CTS-1-78; 1977; 28p  
Sponsored by Dept. of Transport, Road and Motor Vehicle Traffic Safety Branch (Canada).  
Availability: Ministry of Supply and Services Canada, cat. no. T46-8/1978

HS-024 671

### AIR CUSHION RESTRAINT SYSTEM (ACRS): A SURVEY OF OWNERS' OPINIONS

Methodology and results are presented of a survey of a sample of owners of General Motors (GM) cars equipped with the Air Cushion Restraint System (ACRS), in order to gather information concerning the accident experience of this group of drivers, as well as other aspects of the "in-car" experience with the ACRS. A specific goal was to discover cases not already detected by the existing reporting system involving both GM and the National Hwy. Traffic Safety Administration. Each owner was sent a postcard, and about five weeks later one out of every 30 respondents was sent a followup letter, resulting in a 58% response rate. The majority of a selected group of respondents (3248 out of 4487) reported no accident, deployment, or checklight problem with their ACRS cars. Among the remaining respondents, 19% reported a nondeployment accident, 1% a deployment accident, and 8% checklight problems. As indicated by comments on the returned postcards, many respondents had a favorable attitude toward ACRS. Of those who commented, most felt safer with ACRS in the car and were willing to pay the extra cost or to make an extra effort to purchase the ACRS. Many owners seemed to believe that the ACRS would give them the same level of protection as seat belts, obviating the need for belts. The

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problems reported by the owners of ACRS cars were related mostly to the checklight, to the horn, and to the inconvenience of purchasing or repairing a car with ACRS. A total of 404 respondents were interviewed by telephone to obtain more detailed information. These interviews indicated that deployment accidents usually involved the ACRS cars hitting other vehicles or objects head-on at high speeds. The nondeployment accidents were usually low-speed crashes that occurred in parking lots or at intersections. The survey findings indicate four previously unreported deployment crashes and four ACRS that deployed inadvertently.

by Livia K. Li; B. J. Campbell  
University of North Carolina, Hwy. Safety Res. Center,  
Chapel Hill, N.C.  
1978; 53p  
Sponsored by General Motors Corp.  
Availability: Corporate author

HS-024 672

### **PASSENGER CAR SPECIFICATIONS**

Passenger car specifications for model years 1966 through 1978 are tabulated in separate sections for U.S. and foreign automobiles. For each make and model, the following data are provided: wheelbase, overall length, width, and height, and curb weight. This manual is intended for use by accident investigators sponsored by industry and government.

Motor Vehicle Manufacturers Assoc. of the United States,  
Inc., 300 New Center Bldg., Detroit, Mich. 48202  
1978?; 40p  
Excerpted from Automotive News' Annual Market Data Book  
Issue.  
Availability: Corporate author

HS-024 673

### **1978 MODEL YEAR PASSENGER CAR AND TRUCK ACCIDENT INVESTIGATORS MANUAL. 8TH ED.**

This 1978 model year U.S. passenger car and truck accident manual is a compilation of data pertaining to these models for use by accident investigators in completing accident reporting forms. Uniform reporting of motor vehicle collision data provides a simple system for storing data elements in computerized data banks. The vehicle data for each of the manufacturers are divided by corporate name (American Motors Corp. (AMC), Chrysler Corp., Ford Motor Co., General Motors Corp., International Harvester Co., and White Motor Co.). The new model dimensional and code data are intended for use by accident investigators sponsored by industry and government. Vehicle Identification Number (VIN) sequence and model information is filed alphabetically. Truck model information follows passenger car data. An introductory section illustrates the Collision Deformation Classification-SAE J224a. AMC data include VIN information, weight and body dimensions, energy-absorbing steering-column devices, and glazing identification markings. Chrysler data include VIN information, weight and body dimensions, and energy-absorbing steering-column devices. Ford data include VIN information, weight and body dimensions, energy-absorbing steering-column devices, and glazing identification markings. GM data include VIN information, energy-absorbing steering-column devices, steering wheel types, glazing identification markings, weight and body dimensions. International Harvester data include VIN information, and weight and body dimensions. White Motor data include

VIN information, weight and body dimensions, and glazing identification number information.

Motor Vehicle Manufacturers Assoc. of the United States,  
Inc., 300 New Center Bldg., Detroit, Mich. 48202  
1978?; 139p  
Availability: Corporate author

HS-024 674

### **DRUGS AND THEIR EFFECT ON DRIVING PERFORMANCE**

A review of the literature is presented pertaining to studies on the association of drug use and traffic accidents. Prescription drugs include the major and minor tranquilizers, antidepressant drugs, amphetamines, and barbiturates; the primary effect of these drugs is to alter mood, perhaps resulting in changed behavior. Research indicates that some of the major tranquilizers may affect performance on motor skill tests, particularly by slowing reaction times. Although few studies have been performed that measure the effects of the minor tranquilizers or antidepressants on driving skills, indication that these drugs impair driving performance invites further investigation. Additional evidence suggests that the effects of alcohol in combination with psychotropic drugs increases impairment of motor skills and driving performance. Researchers highly recommend that patients undergoing drug therapy limit driving as much as possible and avoid drinking alcohol. Marijuana, the hallucinogens, and other illegally-obtained drugs produce intoxicating effects. Research indicates a relationship between impaired driving skills and marijuana use. Increases in speedometer errors, impaired peripheral vision, insufficient caution, and delayed action are among the effects of marijuana intoxication. Other research indicates that the effects of marijuana are similar to those of alcohol. One study on marijuana and car crashes reported that the impairment produced by the combination of alcohol and marijuana is significantly greater than either agent alone. Although very little research is available on the effects of the hallucinogens (lysergic acid, mescaline, psilocybin), one study reported that all groups of illegal drug users studied had higher rates of accidents than a corresponding control group. The need for further research into the behavioral, physiological, and psychological effects of marijuana and the hallucinogens on driving safety is warranted. The unpredictable effects of these drugs, including flashbacks, plus their effects in combination with alcohol, leads one to suspect that an individual's driving may be severely impaired by usage of these drugs.

by Deborah Valentine; Martha S. Williams; Robert K. Young  
University of Texas at Austin, Council for Advanced  
Transportation Studies, Austin, Tex. 78712  
(77)-7200-02-B  
Rept. No. CATS-RR-51; 1977; 55p 89refs  
Sponsored by Texas Office of Traffic Safety.  
Availability: Corporate author

HS-024 675

### **GRAIN ALCOHOL IN MOTOR FUELS: AN EVALUATION**

A literature search and analysis, consultation with many of the authors to obtain further data, and conduct of limited studies to update the authors' findings were undertaken to examine the energy and economic balances associated with ethanol

production from grains produced under energy-intensive agriculture, assuming that the ethanol would be mixed or blended with gasoline. Corn was used as the example of the grain class. Grain sorghum (milo) and corn have similar energy and economic investments for their production and similar yields of ethanol when fermented and distilled. It is believed that using milo as the feedstock in ethanol production would result in conclusions similar to those reached for corn, i.e. energy inefficient and economically infeasible. Ethanol can be produced from many agricultural products, including such feedstocks as sugar cane, sugar beets, sweet sorghum, the starch roots such as yucca and cassava, and even crop residues. The energy investment in crops produced under energy-intensive agriculture probably will preclude their use in ethanol production, although crops produced under different cultivation levels may well yield attractive thermal efficiencies compared to alternative methods of obtaining liquid fuel. When computing these thermal efficiencies, all the energy investment associated with production, transformation, and marketing must be counted. A process can only be termed "renewable" if the current solar energy component in the final product and associated by-products exceeds the investment in fossil fuels. After a process has been judged as the best alternative from an energy analysis, economic analyses could probably assess economic impacts and required subsidy levels, and could evaluate the costs and benefits of alternative methods of reaching the goals of energy conservation and increased agricultural incomes. The choice of data selected from the published literature to illustrate a facet of the economic or energy balances generally favored the case for ethanol as a fuel extender. The rationale for this procedure was that if errors were made, then the energy and/or economic balances for ethanol likely would become more infeasible. Further work by others will establish whether or not the data choices were conservative.

by James G. Kendrick; Pamela J. Murray  
University of Nebraska-Lincoln, Dept. of Agricultural Economics, Lincoln, Nebr.  
Rept. No. DAE-81; 1978; 68p 77refs  
Rept. on Proj. NEB-10-064, "Impact of Public Policies in Nebraska's Agricultural and Rural Development."  
Availability: Corporate author

HS-024 677

### **AUTOMOTIVE ELECTRONICS: CHARGING TOWARD THE 21ST CENTURY**

Today, automotive engineers and those in the electronics industry have created computer controls for many automotive functions, including car radios, fuel systems, and automatic suspension leveling. By 1985, every car sold in the U.S. may have an assortment of sophisticated electronic equipment. Much of this growth will be related to the increasingly stringent fuel economy and exhaust emission standards. Once on the car, computers can be adapted to many purposes, but their most important function today is to meet fuel economy requirements which will rise from 19 mpg in the 1979 model year to 27.5 mpg in 1985. By 1981, when Federal emission standards hit their peak and when the fuel economy standard is 22 mpg, auto engineers expect nearly every car sold in the U.S. to have at least a basic electronically-controlled carburetor and three-way catalytic converter system. By the 1990's, such items as radar braking, automatic load leveling, computer-controlled automatic transmission shift points, fully-integrated controls of major engine functions, trip computers, and many more items will be commonplace, at least on luxury

cars. Dozens of producers of electronic components and systems are competing fiercely for shares in the new electronic market. The U.S. automakers themselves are deeply involved in electronics research and component manufacturing and assembly: General Motors, primarily through its Delco Electronics Div., Ford in its Electronics and Electrical Div., and Chrysler via its Huntsville Electronics Div. Experts generally agree that current dollar volume in automotive electronics, expressed in terms of automaker expenditures, runs about \$1 billion annually. With government regulations providing the impetus, the U.S. auto industry is becoming wedded to the electronics revolution. Among the remaining problems in automotive electronic componentry are reliability and lead time.

by David E. Whiteside  
Publ: Ward's Auto World v14 n11 p37-40 (Nov 1978)  
1978  
Availability: See publication

HS-024 678

### **THE FIRST SIX MONTHS OF TENNESSEE'S CHILD RESTRAINT LAW**

In Sep 1977, a project was initiated in Tennessee to educate the public regarding the dangers of allowing children to ride unrestrained in moving vehicles and to evaluate the results of these efforts and the impact of a Tennessee law (effective 1 Jan 1978). This law required child passengers under four years of age to be restrained by child restraint devices while being transported by their parents or guardians in most motor vehicles (trucks rated at 1 ton or more, and recreation vehicles were excluded). Funding for the project was provided by the National Hwy. Traffic Safety Administration and the Governor's Hwy. Safety Prog. of the State of Tennessee. Through this project, the Tennessee Child Passenger Safety Prog. was developed. On 1 Jan 1978, a major public information and education program was initiated, designed to provide two levels of informational and educational intensity. One level (the basic state program) is an inexpensive plan which provides for the distribution of informational brochures and posters to hospitals, children's clinics, physicians' offices, and other strategic locations throughout the state. The second level (the comprehensive program) consists of a plan whereby television, radio, newspapers and billboards are utilized to inform and educate the public about the law. An evaluation portion of the Program was designed to determine the impact of various elements of the total program. Preliminary results show that each area where data were collected had an increase in the rate of child restraint usage after the law and information program had been in effect for six months. For the baseline data, the rate of usage ranged from a low of 10.7% to a high of 14.0% for urban areas, and a usage rate of 6.5% for rural areas. After six months, the percentages ranged from a low of 16.2% to a high of 25.2% for urban areas, and 15.1% for rural areas. The largest increase in usage rate occurred in Nashville, which was the only target area to receive the comprehensive information program for the operational data period. As part of the evaluation project, a study of deaths and injuries is underway.

by Kenneth W. Heathington; Randy L. Perry  
Publ: Traffic Safety v78 n11 p14-6, 28 (Nov 1978)  
1978  
Availability: See publication

July 31, 1979

HS-024 679

## **GETTING THE MESSAGE TO THE PUBLIC [TRAFFIC SAFETY]**

The most important part of the traffic safety effort is the role played by the individual motorist, motorcyclist, bicyclist, and pedestrian. Engineering can help motorists to avoid accident-producing mistakes and can somewhat reduce the serious consequences of those mistakes. Enforcement and administration can deal usefully with some of the more obvious violations of good driving practice. Truly good driving and pedestrian behavior require a level of excellence in performance beyond the requirements of law and administrative regulation; this behavior demands consistency of performance regardless of enforcement capability. Safety excellence demands a high level of both knowledge and commitment on the part of the individual citizen. The development of this kind of knowledge and commitment requires a many-faceted and continuous effort. To meet the need for continuing driver education, the National Safety Council has established the Defensive Driving Course, now supplemented by similar instruction for motorcyclists. More than 9 million Americans have completed this eight-hour course through hundreds of cooperating organizations. Formal education must be supplemented by continuing advice and encouragement to promote better driving and pedestrian behavior. Intensive efforts by newspapers, broadcasting stations, churches, and community organizations are recommended. Those in the voluntary safety movement must create a climate of safety awareness, must educate people in safety specifics, and must generate public support for the passage and enforcement of necessary laws (e.g. 55 mph speed limit, mandatory motorcycle helmet usage).

by Vincent L. Tofany

Publ: Traffic Safety v78 n11 p8-10 (Nov 1978)  
1978

Availability: See publication

HS-024 680

## **FEDERAL MOTOR VEHICLE FLEET REPORT FOR FISCAL YEAR 1977 (OCTOBER 1, 1976-SEPTEMBER 30, 1977)**

A summary is provided of data forwarded to the General Services Administration by all Federal agencies operating motor vehicles in the U.S. and overseas, regarding their motor vehicle fleet operations during fiscal year 1977. Inventory, cost, mileage, and fuel consumption statistics are tabulated for agency-held, interagency motor pool, and commercial vehicles. Data are further categorized by all agencies and large fleets, worldwide and domestic. Selected data depicting five-year trends are included. Sedans are categorized by class rather than type. No data are available for privately-owned vehicles (POV's), but the use of POV's for official business is a significant cost factor. The following types of vehicles are included as fleet vehicles: sedans of all classes, station wagons, ambulances, buses, trucks, and truck tractors. Energy conservation tips, and a brief glossary are provided.

General Services Administration, Federal Supply Service,  
Washington, D.C. 20406

1978; 40p

Availability: Corporate author

HS-024 684

HS-024 682

## **RIDER SKILL DEVELOPMENT PROGRAM ADMINISTRATIVE REQUIREMENTS**

The Rider Skill Devel. Prog. serves as the training component in the California Motorcycle Licensing Demonstration Proj. under the sponsorship of the National Hwy. Traffic Safety Administration. The Program's purpose is to assist motorcycle license applicants in developing the skills needed to take the Motorcycle Operators Skill Test used in the Demonstration Proj. The Program is offered to individuals who fail the Motorcycle Operator Skill Test, and its sessions rely on an off-street facility, a classroom area and trained instructors. The instructors' training is supported by a separate instructor training package. The full Skill Devel. Prog. requires an applicant to engage in self-practice and attend a three-hour training session. The Rider Skill Devel. Prog. consists of a basic practice guide, on-cycle program, classroom training, and advanced practice guide. Outlined are the administrative requirements for the program (administrative consideration; and equipment, facilities and aids such as motorcycles, lean angle detectors, protective gear, traffic cones and projector). Appendices D and E contain the Rider Skill Devel. Prog. On-Cycle Instructor's Guide and the Rider Skill Devel. Prog. Classroom Training Guide, respectively. Appendices F and G contain the Basic Practice Guide and Advanced Practice Guide, both prepared for motorcycle license applicants. The Motorcycle Operator Skill Test's Administrator's Manual is in Appendix H, and the Examiner's Manual, in Appendix I. Appendix J consists of copies of the data collection forms one through eight.

by Kenard McPherson; A. James McKnight  
National Public Services Res. Inst., 421 King St., Alexandria,  
Va. 22314

DOT-HS-01143

1976; 260p

Prepared for California Dept. of Motor Vehicles.

Availability: California Dept. of Motor Vehicles, Sacramento, Calif.

HS-024 683

## **FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. FINAL REPORT. VOL. 1: EXECUTIVE SUMMARY**

by James F. O'Connor; Alexander H. Riccio  
Hazeltine Corp., Greenlawn, N.Y. 11740

DOT-TSC-1236

Rept. No. UMTA-MA-06-0041-77-4; DOT-TSC-UMTA-77-36-1-5842-Vol-1; 1978; 29p

Rept. for Sep 1976-Feb 1977. For abstract, see HS-024 684 (Vol. 2, Test Results and Data); Vol. 3, Test Histograms, is HS-024 685; Vol. 4, Test Log Sheets, is HS-024 686.

Availability: NTIS

HS-024 684

## **FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. FINAL REPORT. VOL. 2: TEST RESULTS AND DATA**

The Pulse Trilateration Automatic Vehicle Monitoring (AVM) system developed by Hazeltine Corp. is described, and the



testing in Los Angeles) are presented. The Hazeltine system determines the position of mobile units by measuring the arrival times of the leading edges of vehicle pulse transmission at a limited number of fixed receiver sites. Differences in time-of-arrival of the transmissions are used by a central processor to compute the coordinates of the mobile units. Fixed signpost transmitters are used to improve time of passage accuracy at slow vehicle speed locations. The Hazeltine system covers fixed route, random route, and special-case situations, in both low- and high-rise regions, and provides time-of-departure data for fixed route bus/transit applications. Data acquisition is automatic, with the basic data recorded on magnetic tape. Evaluation of the system's performance is provided by off-line simulation. During a testing program in Philadelphia in the winter of 1976-1977, the Hazeltine AVM system exhibited a location accuracy of 270 ft at the 95th percentile in suburban areas, and 460 ft (95%) in a congested, downtown high-rise district. The corresponding average errors (at the 50th percentile) were 97 ft and 140 ft, respectively. The performance goal of 300 ft (95%) throughout the Los Angeles coverage area will be met using fixed-site receivers which are sited more optimally than those used in the Philadelphia test program. Time-of-passage accuracy (used to signal the departure of a bus from a designated point) of plus/minus 15 sec (92%) was achieved without signposts in the suburban environment, and with a limited number (15) of signposts along the fixed routes. The digital communications link which is an integral part of the Hazeltine AVM system was validated, exhibiting coverage levels of 98.5% in the downtown areas and 99.8% in suburban areas, exceeding the requirement of 95%. The Philadelphia test experience is further verification that pulse trilateration AVM is technically and economically feasible for deployment in a broad range of vehicle fleet management systems.

by James F. O'Connor; Alexander H. Riccio  
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DOT-TSC-1236  
Rept. No. UMTA-MA-06-0041-77-5; DOT-TSC-UMTA-77-36-1-5842-Vol-2; 1978; 266p 2refs  
Rept. for Sep 1976-Feb 1977. For summary report, see HS-024 683 (Vol. 1, Executive Summary); Vol. 3, Test Histograms, is HS-024 685; Vol. 4, Test Log Sheets, is HS-024 686.  
Availability: NTIS

HS-024 685

### **FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. FINAL REPORT. VOL. 3: TEST HISTOGRAMS**

Time-point and location-accuracy histograms are presented which reflect the results of a test program of the Pulse Trilateration Automatic Vehicle Monitoring (AVM) system developed by Hazeltine Corp. which was conducted during the winter of 1976-1977 in Philadelphia. The data cover fixed route, random route, and special-case situations in urban and suburban areas. Time-of-departure data for fixed route

bus/transit applications are obtained using the Hazeltine AVM system.

by James F. O'Connor; Alexander H. Riccio  
Hazeltine Corp., Greenlawn, N.Y. 11740  
DOT-TSC-1236  
Rept. No. UMTA-MA-06-0041-77-6; DOT-TSC-UMTA-77-36-1-5842-Vol-3; 1978; 99p  
Rept. for Sep 1976-Feb 1977. Vol. 1, Executive Summary, is HS-024 683; Vol. 2, Test Results and Data, is HS-024 684; Vol. 4, Test Log Sheets, is HS-024 686.  
Availability: NTIS

HS-024 686

### **FIELD TESTING OF A PULSE TRILATERATION AUTOMATIC VEHICLE MONITORING SYSTEM IN PHILADELPHIA. FINAL REPORT. VOL. 4: TEST LOG SHEETS**

For a test program of the Pulse Trilateration Automatic Vehicle Monitoring (AVM) system developed by Hazeltine Corp. which was conducted during the winter of 1976-1977 in Philadelphia, the following information is provided: a list of six aborted test runs together with an explanation of why each of these runs was terminated; identification and explanation of eight fixed route tests which were not included in fixed route summations, and two others which inadvertently were omitted from fixed route summations for a small triangle; and vehicle log sheets which were filled out during each of the tests. The Hazeltine system was applied to fixed route, random route, and special-case situations in urban and suburban areas. Time-of-departure data for fixed route bus/transit applications are obtained using the Hazeltine AVM system.

by James F. O'Connor; Alexander H. Riccio  
Hazeltine Corp., Greenlawn, N.Y. 11740  
DOT-TSC-1236  
Rept. No. UMTA-MA-06-0041-77-7; DOT-TSC-UMTA-77-36-1-5842-Vol-4; 1978; 178p  
Rept. for Sep 1976-Feb 1977. Vol. 1, Executive Summary, is HS-024 683; Vol. 2, Test Results and Data, is HS-024 684; Vol. 3, Test Histograms, is HS-024 685.  
Availability: NTIS

HS-024 687

### **RIDE SAGELY [MOTORCYCLE SAFETY]**

Techniques of defensive motorcycle riding are based on attention and anticipation of possible dangers, especially from automobiles. Motorcycle accidents are usually the result of under-experience or overconfidence. Knowledge of and adherence to traffic regulations, including proper licenses, are basic safety techniques. Maintaining a flow-of-traffic pace is important for motorcycle safety, as is keeping a proper distance from other vehicles. Use of two rearview mirrors, turn signals, and protective clothing is recommended. Awareness of road traffic further ahead is important for avoiding dangerous predicaments. It is recommended that a motorcyclist generally position his vehicle in the left portion of the right lane for greater visibility by automobile drivers and to avoid oil and road debris. Signalling before changing lanes is especially important for a motorcyclist, as is not riding faster than the visibility permits, even on familiar roads. Previous planning of routes and freeway exits enables the motorcyclist to avoid quick lane changes. Especially in city traffic, parked cars are a danger to cyclists. Intersections are particularly dan-

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gerous, due to unsignalled turns and violations of stop signs by motorists. Although riding with headlights on and using high-visibility clothing will increase the cyclist's visibility to motorists, the cyclist should not rely upon being seen. Alertness and caution, with consideration of possible escape routes, are the best attributes for motorcycle safety. Proper maintenance of motorcycle and equipment, and the physical condition of the rider, are also important prerequisites for preventing motorcycle accidents.

by Roger Hull  
Publ: Driver v12 n6 p0-1, 3-8 (Nov 1978)  
1978  
Availability: See publication

HS-024 688

### **"DUMMIES" WORK FOR GM [AUTOMOBILE CRASH TESTING, GENERAL MOTORS PROVING GROUND]**

At the General Motors Proving Ground at Milford, Mich., 54 dummies are used around-the-clock in car tests in the safety research and development laboratory. The ultimate goal of their use is to better the safety performance of vehicles by improving restraint systems and creating safer car interiors. Each \$11,000 dummy is aluminum-headed, vinyl-coated, and fully-instrumented. Their outer skin is not intended to simulate human skin or flesh. Of the dummies, 36 are 50th percentile males, i.e. they are average height and weight, weighing 167 lb and measuring 5 ft, 10 in. The remaining dummies are larger males, women, and a few children or babies. Instrumentation inside the head, the chest, and the thigh areas helps to measure the force the dummy applies to a vehicle, or vice versa, in a crash. Target points marked by yellow circles on the dummy can be measured on film for such research information as movement, speed, and distance traveled. It takes from two hours to half a day to rig a dummy for a test. Two tests are run on each of the lab's two high-G impact sleds each day, each ride lasting about one-tenth of a second. Although dummies are also used in simulated collisions in actual vehicles, the impact sleds are used for everyday testing.

by Ed Janicki  
Publ: Driver v12 n6 p20-1 (Nov 1978)  
1978  
Reprinted from California Highway Patrolman.  
Availability: See publication

HS-024 689

### **AUTOMOTIVE PAINTING. AUTOMOTIVE BEAUTY IS ONLY SKIN-DEEP**

Information is presented on paint and other equipment needed by the amateur in order to give his car a paint job. The two basic ingredients of paint for automotive applications (the volatiles, the film-forming materials) are identified and are further classified (binder, pigment). The characteristics of lacquers (nitrocellulose and acrylic) and synthetic enamels are compared; information is provided for identifying the type of finish presently on one's car. The use of thinners and reducers, wax, polish, and grease removers, metal-conditioning fluids, and tack rags is explained. The construction of a spray gun is described and illustrated; the varieties of each of the two basic types of spray guns (gun and paint container as a single unit, gun separate from paint supply) are described;

these include bleeder, nonbleeder, external-mix, internal-mix, and pressure, gravity, or suction-feed guns. Step-by-step procedures for cleaning a spray gun are outlined, using a suction-feed gun as the example. Basic paint shop (paint booth or enclosed garage) safety rules are given, especially related to fire hazards. Protective clothing is recommended, as well as air filtration equipment. Photographs of cartridge-type and filter-type respirators are included. A chart lists the types of paint solvents and the toxic effects from their inhalation.

Publ: Driver v12 n6 p22-7 (Nov 1978)  
1978  
At head of title: The Backyard Mechanic--Back to Basics.  
Availability: See publication

HS-024 691

### **STATISTICAL ANALYSIS OF FHWA [FEDERAL HIGHWAY ADMINISTRATION] TRAFFIC NOISE DATA. FINAL REPORT**

A study was undertaken to analyze the relevant part of a set of traffic noise emission data collected in 1975 along highways in Colorado, Florida, North Carolina, and Washington by the Transportation Systems Center, in order to examine the underlying relationship between the truck noise emission levels measured, and the physical and operational characteristics of the trucks recorded during the data collection process. Prediction equations of the peak dBA levels of trucks as functions of speed were derived for each of the axle groups (2, 3, 4, 5, 6, 3-5), and each of the four states. These equations were used to establish vehicle reference emission levels for medium and heavy trucks. Similar results were derived for noise levels in octave bands at frequencies 31.6 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1K Hz, 2K Hz, 4K Hz, and 8K Hz. Attenuation rates were estimated for each of the states. Results can be used in highway noise prediction models.

by Y. Y. Ma; F. F. Rudder, Jr.  
Science Applications, Inc., Energy and Environmental Sciences, 1651 Old Meadow Rd., McLean, Va. 22101  
DOT-FH-11-9384  
Rept. No. FHWA-RD-78-64; 5-451-00-066-01; 1978; 71p 7refs  
Rept. for Dec 1977-Jun 1978.  
Availability: NTIS

HS-024 692

### **TABULATION OF SELECTED LOW-ALTITUDE VEHICLE EMISSION FACTORS BASED ON EPA'S [ENVIRONMENTAL PROTECTION AGENCY] MOBILE SOURCE EMISSION FACTORS DATED MARCH 1978**

Tables are provided which offer a limited alternative to using the MOBILE 1 computer program; with proper care, the user (assumed to be familiar with the Environmental Protection Agency's "Mobile Source Emission Factors," Mar 1978) should be able to determine under what conditions and for what types of analyses these tables of selected low-altitude vehicle emission factors are suitable. The tables were generated by running MOBILE 1 for a variety of input conditions. An attempt was made to include within the scope of the tables a range of conditions which would be encountered in an actual analysis. For example, speeds range from 5 mph to 50 mph, analysis years extend from 1975 to 1999, temperatures vary from 0 degrees F to 80 degrees F, and percent cold

transient vehicle operation ranges from 0% to 100%. In addition, the tables are set up so that any mix of vehicle types can be considered. In order to keep the tables to a manageable size, the following simplifying assumptions were made: no inspection/maintenance program assumed to exist, percent cold transient operation equal for noncatalyst and catalyst-equipped vehicles, percent hot transient operation equal to zero, average speed assumed equal for all three bags of the Federal Test Procedure, non air-conditioning usage assumed, no vehicle load correction assumed, no trailer towing assumed, and no humidity correction for nitrogen oxides assumed. The emission factors are formatted into separate tables for carbon monoxide, hydrocarbon, and nitrogen oxides.

Federal Hwy. Administration, Noise and Air Quality Branch,  
Washington, D.C. 20590  
1978; 142p  
Availability: Corporate author

HS-024 693

### GLOSSARY OF URBAN PUBLIC TRANSPORTATION TERMS

A glossary is presented with the aim of organizing and standardizing terms related to urban public transportation, thus assisting transit system operators to understand the analytical language of urban planners and the latter to understand the operational language of transit system operators. It should serve as well as a basic reference for anyone interested in the subject. Approximately 50 sources are listed as assisting and commenting. The definitions are organized alphabetically by term; acronyms and abbreviations are presented at the beginning of each section.

by Amy E. Shaughnessy, ed.  
Transportation Res. Board, Subcommittee on Definitions, 2101  
Constitution Ave., N.W., Washington, D.C. 20418  
Rept. No. SR-179; 1978; 44p  
Availability: TRB \$3.00

HS-024 695

### ROUTE CHOICE BY DRIVERS

Two experiments were designed to determine how drivers locate unfamiliar destinations and how efficiently they do so. Two different groups of drivers were asked to drive from the Transport and Road Res. Lab. to destinations in Chertsey and Bedford, distances of approximately 25 km and 100 km respectively. The time taken and distances travelled to the destinations were compared with similar data obtained when the subjects were given guidance on the optimum return routes. Day and nighttime driving were also studied on the Chertsey experiment. Beside considerable wastage in reaching the outskirts of the towns, difficulty was found in locating final destinations. Results of both experiments were similar; time and distance excess approximately equal in percentage terms: 20% on Chertsey test and 12% on Bedford. The national average wastage on all journeys is estimated to be at least 4%, much of it committed unwittingly, while between 25% and 55% of all drivers might incur en route journey costs greater than 10% in excess of minimum route costs. Some errors could have been avoided by improved signing and better

maps, although performance of drivers who used maps was not significantly better than those who did not.

by Sheila E. Lunn  
Transport and Road Res. Lab., Hwy. Traffic Div.,  
Crowthorne, Berks., England  
Rept. No. TRRL-SR-374; 1978; 29p 9refs  
Availability: Corporate author

HS-024 696

### A SURVEY OF SOUTHBOUND MOTORWAY [HIGHWAY] TRAVEL ON THE M6, M5 AND M1 IN 1975

Photographic techniques were used to establish flow patterns of southbound traffic on the M6, M5 and M1 motorways (highways) and A74, following a similar but less extensive survey made in 1974. Data were gathered from selected locations by recording registration numbers on 35mm film at main sites supported by 16mm filming and manual recording at other locations. The analysis was carried out by computer programs and involved matching the vehicle registration numbers at the various sites. In all, 7383 cars and light vans were identified as passing at least two of the major sites under observation; details of where these vehicles joined and left the motorways are given. The survey could be extended to deal with commercial traffic on the same principles. Appended are data from minor sites, the determination of error rates (due to illegibility or misreading of number plates), and a definition of registration areas.

by E. J. Hardman  
Transport and Road Res. Lab., Assessment Div., Crowthorne,  
Berks., England  
Rept. No. TRRL-LR-842; 1978; 28p 1ref  
Availability: Corporate author

HS-024 697

### ACCIDENTS ON URBAN ARTERIAL ROADS

A detailed investigation was made of road and environmental features affecting accident rates on the main traffic routes in four towns in Southern England. Details of over 1000 personal injury accidents were examined and the main types of accidents identified. Accident rates along sections of road passing through different types of land use were compared and the rate was found to be highest on roads passing through suburban shopping areas, and at a few very busy junctions. As 42% of all the accidents reported occurred on just 18% of the arterial road network, application of safety measures to this comparatively small part of the network should produce a substantial reduction in overall accidents. One-fifth of all accidents studied involved vehicles emerging from side roads into the path of vehicles on the main road; remedies include improving vehicle conspicuity, particularly that of two-wheeled vehicles, installation of small traffic circles at suitable sites, improving the conspicuity of junctions by installing such features as central islands, more adequate control and the banning of right turns at some sites. Care should be taken that such changes do not result in more accidents elsewhere than are being saved at the original location. In reducing pedestrian

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accidents, the installation of guard railings along some lengths of road is suggested.

by R. G. Chapman  
Transport and Road Res. Lab., Accident Investigation Div.,  
Crowthorne, Berks., England  
Rept. No. TRRL-LR-838; 1978; 21p 2refs  
Availability: Corporate author

HS-024 698

### **ROAD ACCIDENTS IN TRADITIONALLY DESIGNED LOCAL AUTHORITY ESTATES [SUBDIVISIONS]**

Accident records for about 9000 streets in local authority residential estates (subdivisions), free from substantial through traffic, in 20 towns, were analyzed in relation to population statistics, traffic flow, observations of children and parked vehicles, design parameters, etc., using multiple regression and other techniques. Emphasis was on pedestrian accidents, which were predominantly to children. Accident rates (per house, or per person, per year) were found to be strongly correlated with traffic flow and with design factors such as street length, highway width, presence of shops, schools and buses, which were themselves strongly correlated with traffic flow. Rates in culs-de-sac were very low. The multiple regression analysis suggested that the direct effects of factors such as road width and curvature were probably not large, and might be either positive or negative. Similar conclusions were reached for parking densities and car ownership rates. A serious problem of child pedestrian accidents was noted in traditionally designed estates. The low accident rates in culs-de-sac (and also in 'segregated' estates) may indicate that better design might achieve substantial improvements.

by G. T. Bennett; Jean Marland  
Institution of Hwy. Engineers [England]  
Rept. No. TRRL-SR-394; 1978; 43p 2refs  
Sponsored by Transport and Road Res. Lab.  
Availability: Transport and Road Res. Lab., Road User  
Characteristics Div., Crowthorne, Berks., England

HS-024 699

### **EMERGENCY MEDICAL CARE**

Papers on emergency medical care, edited from oral presentation format, are presented with editorial comments under the following headings: Establishing and Assessing Emergency Medical Services; Emergency Medical Equipment and Communications; Transportation; Training and Treatment; and A Remote Emergency Medical Care System. The objectives of emergency medical services are considered, as well as the type of system required to deliver these services and the constraints under which the system must function. The viewpoints of the private foundation, the Federal government, and the regional administration are represented. Work of the NASA Johnson Space Center includes the successful application of space technology to problems of health care on earth, especially system technology for delivery of general health care to remote, sparsely populated areas, and communication services for general and emergency care. Land vehicles and helicopters are considered for emergency medical transportation. Descriptions are presented of physician training (familiarization with mobile intensive care and use of field and base facilities), and instruction and certification of emergency medical technicians and paramedical personnel. The configuration and staffing of

trauma units are discussed, as well as their service role in the emergency system. Australian emergency medical services are representative of a system serving a truly remote population, and provide an example of the use of fixed-wing aircraft for emergency transportation and the extensive use of an organized volunteer force. Conclusions drawn from the papers are that money and politics are significant barriers to good emergency care, as are lack of well-defined objectives, and complications stemming from involvement by the Federal government. Among the accomplishments made are development of a system concept, definition of organizational structure, and establishment of guidelines for cooperation among different jurisdictions.

by William M. Portnoy, ed.  
Texas Tech Univ., Lubbock, Tex.  
1977; 182p refs  
Papers presented at International Conference on Remote  
Emergency Medical Services, Lubbock, 15-16 May 1975.  
Meeting sponsored by NASA Johnson Space Center and  
Texas Tech Univ.  
Availability: Lexington Books, D.C. Heath and Co.,  
Lexington, Mass.

HS-024 700

### **ALCOHOL TRAFFIC SAFETY PROGRAM**

A booklet was prepared by the Dept. of Licensing to assist in understanding the cooperative program for rehabilitating the problem drinking driver entered into by the Community Alcoholism Centers, the Alcohol Treatment Facilities, the Dept. of Social and Health Services and the Dept. of Licensing. Procedures dealt with include driver license suspension, license reinstatement and occupational licenses. The habitual traffic offender, implied consent and deferred prosecution laws are also covered. Further material outlines the inter-agency program dealing with the problem drinking driver, including copies of the suspension notice's cover letter, an Alcohol Treatment Certificate, a schematic of the certification system, and a graph showing relative risk of drinking drivers causing a traffic mishap.

State of Washington Dept. of Licensing, Driver Improvement  
Div., Highways-Licenses Bldg., Olympia, Wash. 98504  
1978; 13p  
Prepared as part of cooperative program between Community  
Alcoholism Centers, Alcohol Treatment Facilities, Dept. of  
Social and Health Services and Dept. of Licensing.  
Availability: Corporate author

HS-024 701

### **THE IMPACT OF REINFORCED PLASTIC COMPOSITES ON THE AUTOMOTIVE INDUSTRY**

Since the introduction in 1955 of the Chevrolet Corvette with a glass fiber reinforced polyester body shell, the use of reinforced plastic composites in the automotive industry has continued to grow at an accelerated rate. These materials represent one of the major technical advances achieved by both the plastics and automotive industries. Progress in polymer science has led to the development of a wide range of nonmetallic engineering compounds and associated processing methods. The division in base polymer types is quite distinct between thermoset and thermoplastic, but recent developments have led to the combining of the two groups into compounds of particular importance in the automotive industry.

Parallel developments in the reinforcement and filler material fields made it possible to combine polymer, reinforcement, and filler, to create compounds designed specifically to fit individual applications. A discussion is presented of material and process development of thermoset and thermoplastic compounds, developments associated with the international automotive industry, and their relative importance to the South African industry. Energy realities dictate that the auto industry can survive only if it manufactures low-cost, small, lightweight components which offer savings in fuel consumption; and it is in achieving these objectives that reinforced plastic composites are playing, and will continue to play, an ever-increasing role.

by E. A. Pears  
Fibreglass Filaments (Pty) Ltd.  
Rept. No. N78-25202; HC-A02/MF-A01; 1978?; 20p 10refs  
Presented at 1st South African Conference on Plastics in the Service of Man.  
Availability: NTIS

HS-024 702

**CRASH HELMETS FOR MOPED RIDERS. RESULTS OF SURVEYS OF MOPED OWNERS AND STUDIES OF HELMET USE BY MOPED RIDERS. INTERIM REPORT OF THE STEERING COMMITTEE OF THE CRASH HELMET CAMPAIGN (BROMFIETSHELMEN. RESULTATEN VAN ENQUETES BIJ BROMFIETSBEZITTERS EN VAN TELLINGEN VAN HET HELMGEBRUIK DOOR BROMFIETTERS. INTERIM-RAPPORT T.B.V. DE STUURGROEP CAMPAGNE BROMFIETSHELMEN) [NETHERLANDS]**

Preliminary results of a survey of safety helmet ownership and usage among moped owners in The Netherlands at the end of 1974 are tabulated and discussed. Statistics are provided from earlier surveys (early and late 1973, early 1974) for comparison purposes. It was found that by the end of 1974, two out of three moped owners had helmets and the use of the helmets had increased sharply in the course of the year. It is felt certain that the impending initiation of the country's mandatory helmet usage law (first announced as being put into effect 1 Nov 1974, later changed to 1 Feb 1975) played an important role in this increased usage. There are some groups, however, where helmet ownership or usage is still relatively low; they are older men (especially retired persons), housewives, and moped passengers. It seems logical to assume that these groups need their mopeds less frequently and that many of them are probably postponing the purchase and/or use of a helmet until they find the use of the moped indispensable.

by P. C. Noordzij  
Stichting Wetenschappelijk Onderzoek Verkeersveiligheid (SWOV), Voorburg, Netherlands  
1975; 24p  
Translated from Dutch (original 14p; translation 10p).  
Availability: Reference copy only

HS-024 703

**TESTS TO BE CARRIED OUT IN ITALY ON THE AMERICAN RSV/CALSPAN VEHICLE (PROVE DA EFFETTUARE IN ITALIA SU VEICOLO**

**AMERICANO RSV/CALSPAN) [RESEARCH SAFETY VEHICLE]**

A list of the tests to be performed in Italy on the Calspan RSV (research safety vehicle) is provided, with a brief description of the general conditions and procedures to be used. Included are drawings of the test track to be used, configurations for various tests to be performed, and technical data sheets on certain instrumentation (pedal dynamometer, fuel consumption meter, test run recorder). The following tests will be conducted by the Istituto Sperimentale Auto e Motori S.p.A. (ISAM), Anagni, Italy: fuel consumption (constant speed), performance (top speed, acceleration and pickup, power at the wheel), handling (slalom, overtaking, cornu spiral, steering pad, speed track), braking, and driver compartment physiology and ergonomics (noise, pedal effort, driving position, visibility).

Ministero dei Trasporti, Centro Superiore Ricerche e Prove Autoveicoli e Dispositivi, Rome, Italy  
Rept. No. 17/78ESV; 1978; 43p  
Translated from Italian (original 23p; translation 20p).  
Availability: Reference copy only

HS-024 704

**THE RELATIONSHIP BETWEEN OCCUPANT SAFETY AND THE PROPORTION OF SMALL CARS ON THE ROAD**

An analysis is made of the probability of fatality given a crash between two cars in a population varying from all small cars (i.e. all under 3500 lb) to all large cars, taking into account what is known about the effect of occupant age. It is shown that the probability of fatality decreases linearly with the percentage of small cars in the population, because of the preponderance of young people in small cars and because of increased "small-small" car crashes. Most accidents happen to younger people; they have a better chance of surviving in a crash than older people, and a better chance in a "small-small" crash than in a "large-large" collision. As the small car percentage approaches 100%, the overall chance of fatality may increase slightly after some minimum point. If so, this indicates that the public would be slightly better off, at least as far as the overall chance of dying in an accident is concerned, if a small stock of large cars was retained for older people who seem to have a greater need for occupant protection properties. The CALSPAN SMAC (Simulation Model of Automobile Collisions) program was run in identical collisions (right angle crash at 30 mph speed for each car) on pairs of cars weighing 4865 lbs and 3550 lbs per car. The deceleration forces were greater in the small car collision (up to 17 g's versus up to 14 g's), but the frontal crash and side penetration were smaller (about 11 in versus 14 in).

by Fred L. Preston; James O'Day  
University of Michigan, Hwy. Safety Res. Inst.  
Rept. No. SAE-770807; 1977; 12p 9refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Availability: SAE

HS-024 705

**LIGHTWEIGHT VERSUS HEAVYWEIGHT--THE CONTEST OF THE FUTURE**

Possible future trends in highway accident injuries and fatalities are established through 1985. The change in vehicle mix is

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estimated on a year by year basis; a detailed projection is made of injuries and fatalities which would occur by model year and vehicle class in each year to 1985. Owing to the greater risk of injury and death on the part of occupants of small cars relative to large, a rising trend is seen as the proportion of lightweight vehicles increases. Fatalities in small cars will tend to grow from 41% of automotive occupant deaths in 1975 to 69% in 1985, resulting in at least an overall 35% increase in fatalities during the next decade. This will be due fundamentally to the consequence of smaller vehicles colliding with the older and generally heavier cars. The greater momentum of the heavier units at any impact velocity results in an increased relative impact severity for the lighter car. The smaller vehicles are less crashworthy because of the shorter distances available to decelerate the occupant and the greater likelihood of intrusion into the passenger compartment. The study assumes no changes in the use of occupant restraint systems.

by Robert F. McLean  
John Z. De Lorean Corp.  
Rept. No. SAE-770809; 1977; 8p 6refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Availability: SAE

HS-024 706

#### **WIDE AREA DETECTION SYSTEM. CONCEPTUAL DESIGN STUDY. INTERIM REPORT**

The objective of the Wide Area Detection System (WADS) Proj. is to determine the technical feasibility of using state of the art imaging (such as television) and processor (such as microprocessor) technology to build an integrated sensor for traffic surveillance on mainline sections of urban freeways. This sensor would be capable of automatically making "area" measurements, i.e. across several lanes as well as along the traffic stream in each lane; such measurements as lane density, speed and volume would be transmitted back to the central control facility by conventional means and a set of WADS sensors would thus be deployed to cover the entire length of the freeway. The freeway image would also be used for surveillance and incident diagnosis. The WADS project consists of two phases: a conceptual design study, and building a "breadboard" operating sensor. Results of the study phase are documented, including the functional requirements for the sensor, the survey of applicable imaging and processor technology, and the conceptual design of the breadboard sensor. Results indicate that a WADS is feasible and potentially beneficial for traffic control. A standard TV image sensor had adequate resolution and sampling rate to provide for incident verification and automatic traffic monitoring. Although preferable, an infrared image sensor is too expensive compared with the visual TV sensor. The memory and computational hardware is available and adequate for WADS, but WADS' requirements for practical image processing is at the limit of current state-of-the-art. The production WADS is expected to consist of a CCD image sensor and a microprocessor. The WADS breadboard is recommended to consist of a standard Vidicon television camera and a minicomputer, to provide more flexibility and software support during the testing phase; the proposed image processing algorithm for WADS centers around a Vehicle Detection and Tracking Algorithm which reduces the image data to vehicle descriptions and trajectories, an approach which makes full use of the power of an image sensor, but in a manner convenient for a traffic engineer to apply. More information is needed concerning the oc-

cultation limits caused by the view geometry, and the limitation of bad weather conditions, as well as additional assessment of the impact of WADS on a total traffic monitoring and control system.

by E. E. Hilbert; C. Carl; W. Goss; G. R. Hansen; M. J. Olsasky; A. R. Johnston  
Jet Propulsion Lab., 4800 Oak Grove Drive, Pasadena, Calif. 91103  
Purchase-Order-6-1-0107  
Rept. No. FHWA-RD-77-86; FCP-22L1-072; JPL-78-32; 1978; 183p 36refs  
Rept. for Aug 1976-May 1977.  
Availability: NTIS

HS-024 707

#### **DETERMINATION OF MOTOR VEHICLE EYE HEIGHT FOR HIGHWAY DESIGN. FINAL REPORT**

A study was made of the current eye height distribution among passenger cars and the eye height and field of vision among trucks. Methods employed were a comprehensive literature review of eye height studies, a field study of eye height distribution among the most popular makes of 1975 and 1976 passenger cars, a field study on the field of vision among trucks, and interviews with representatives from the major American automobile manufacturers. A slight decrease in eye height among passenger cars within the last 15 years was found; there were no significant differences between the eye height distribution of passenger cars as stated in the literature and those used in the pilot study. The field studies determined the automobile mean eye height of the sample cars to be 3.69 feet (1.12m) and the 15th percentile to be 3.49 feet (1.06m), while the sampled truck mean eye height was determined to be 8.41 feet (2.56m) and 7.80 feet (2.39m) for the cab-over-engine (COE) and the cab-behind-engine (CBE) configurations, respectively. The COE provides far greater forward and downward visibility than the CBE. Based upon the driver eye height dimensions and trend into the late 1970's as determined from published literature and validated in this study, and the desire to design safely for the great majority of drivers, an eye height dimension of 3.45 feet (1.05m) is recommended for highway design.

by Miller W. Boyd; Arthur C. Littleton; Ronald E. Boenau; George B. Pilkington, 2nd.  
Urban Behavioral Res. Associates, Inc., 3518 Laclede Blvd., St. Louis, Mo. 63103  
DOT-FH-11-9141  
Rept. No. FHWA-RD-78-66; FCP-31J1212; 1978; 46p 29refs  
Rept. for Sep 1976-Apr 1978.  
Availability: NTIS

HS-024 708

#### **PROJECTED MOTOR VEHICLE REGISTRATION AND DRIVERS LICENSES OUTSTANDING 1978-2005**

The report presents a set of vehicle registration estimates (to year 2005) by county for California for passenger vehicles, commercial vehicles, trailers and motorcycles. Also included are estimates on the number of driver license holders statewide (to year 2005) and various driver distributions by county, age and sex. Estimates are included on the number of undocumented vessel registrations and off-highway vehicle registrations (to year 2005), with county distributions for these items. Necessary revision of these estimates is anticipated at least

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every two years. The information is based on the assumption that the automobile will continue to be the basic form of transportation in California, and that developmental work on mass transportation systems will have a minimal impact on the number of registered vehicles.

California Dept. of Motor Vehicles, Forecasting Unit, P.O. Box 1828, Sacramento, Calif. 95809  
Rept. No. DMV-48(3RD.-ED.); 1978; 33p  
Availability: Corporate author

HS-024 709

### **JAPANESE GOVERNMENT WHITE PAPER ON TRANSPORTATION SAFETY. 1978 ED.**

This eighth annual report presented to the Japanese diet deals primarily with the transportation accident situation in Japan in 1977, and the present status of traffic safety policies implemented during 1977; considerable mention is made of traffic safety policies and plans for 1978. Two major sections deal with the traffic accident situation and traffic safety measures. Road, railway, marine, and aviation transportation are covered separately. In road and highway traffic accidents, the number of fatalities was 8945 in 1977, an 8.19% decrease compared to 1976. For the first time in 19 years, less than 9000 people were killed, a decrease of about 7800 deaths compared to the peak year of 1970. In 1977, about 590,000 people were injured in automobile accidents (a decrease of 3.4% compared to 1976) and the first time in 11 years that fewer than 600,000 people were injured. Although there was a considerable decrease in the fatality statistics in 1977, specific traffic safety problems are observable and remain to be solved. There are tremendous regional differences in the rates of fatal accidents, with considerable variations among prefectures and among the metropolitan areas. Pedestrian deaths were less than those for persons riding in automobiles during 1977, as in 1976, but pedestrian and bicycle deaths together accounted for one-half of total traffic deaths. The number of fatalities in all age groups decreased, but to a lesser degree for children and the elderly. A high percentage of fatal accidents were the result of such offenses as drunken driving, speeding, and driving without a license. Of the 2361 people killed or injured in train traffic accidents, over half of the deaths and injuries occurred at railroad-highway intersections, yet the accident statistics were lower in spite of increasing speeds and congestion in train traffic. Decreases are also reported in shipping losses of life and property. A significant decrease has also occurred in domestic air traffic accident rates. Among the traffic safety measures developed in 1977 were augmentation of sidewalks and traffic lights, promotion and development of more effective traffic regulations, improved safety features in vehicles, strengthening of traffic guidance and control, and increased recognition of the need for a traffic safety movement and traffic safety education.

Ministry of State, Prime Minister's Office, Japan  
1978; 247p refs  
Availability: International Assoc. of Traffic and Safety Sciences, 6-20, 2-chome, Yaesu, Chuo-ku, Tokyo, 104, Japan

HS-024 710

### **DIGITAL CALCULATION OF THE OPERATING PARAMETERS OF THE MERCEDES-BENZ ACCIDENT SIMULATOR (DIE DIGITALE**

HSL 79-0

### **BERECHNUNG DER BETRIEBSPARAMETER DES MERCEDES-BENZ UNFALLSIMULATORS)**

The mathematical model developed for the Mercedes-Benz accident simulator involves the transient gas flow between loading chamber and thrust chamber, the kinetics of sled motion and the change in gas volumes, gas pressure areas, and gas flow cross sections for thrust piston motion. A time increment method was selected which allows time increments to be arbitrarily small and allows the method to be programmed on a digital computer. Results of the model's calculations are in good agreement with actual values. The model can predict the entire system of operating parameters necessary for simulation of a desired momentum sequence. A control needle was developed which effects acceleration momentum corresponding more to the variation in the case of actual impact of the vehicle against a fixed barrier.

by Jurgen Arnemann; Eberhard Decker  
Publ: ATZ Automobiltechnische Zeitschrift v80 n6 p293-4 (1978)  
1978; 9p  
Translated from German (original 2p; translation 7p).  
Availability: Reference copy only

HS-024 711

### **GERMAN AUTOMOBILE PRODUCTION IN 1977 COMPARED TO PREVIOUS YEARS (DEUTSCHE AUTOMOBILPRODUKTION 1977 IM VERGLEICH ZU FRUHEREN JAHREN)**

The 1977 production figures for German automobile manufacturers are 4.1 million vehicles produced domestically and an additional 1 million produced outside the country. Domestic production included 3.8 million passenger vehicles including station wagons and about 310,000 commercial vehicles; the former increased 7% and the latter decreased 2%. Foreign production of German vehicles decreased 1% for passenger vehicles and increased 14% for trucks. Domestic passenger vehicle licenses reached a new high of 2,561,278. Export of German motor vehicles rose 4.1% in 1977, but the rise was limited to passenger vehicles; export of commercial vehicles dropped. The market share of German passenger vehicles in North America rose 4.3%; the market share of Japanese manufacturers, on the other hand, rose 12.4%. Production expansion in Germany since 1970 was limited to 7% (compared with Japan--60%, France--40%, Spain--113%), due to revaluation of the German mark and high wages. If one includes the total production of the German automobile industry (both within and outside the Federal Republic), production rose 14%. The share of German motor vehicles in worldwide production dropped to 12.5%, compared with 12.8% in 1976 and 15.3% in 1970.

Publ: ATZ Automobiltechnische Zeitschrift v80 n6 p295-6 (1978)  
1978; 8p  
Translated from German (original 2p; translation 6p).  
Availability: Reference copy only

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HS-024 712

## **AN ANALYSIS OF AUTOMOBILE WEIGHT AND ITS REDUCTION BY ALUMINUM SUBSTITUTION**

Influence coefficients are developed which relate a weight change in an automobile component to the total vehicle weight change that could result; substitution of aluminum for steel is calculated to demonstrate the use of the coefficients. Components of vehicle weight may be product-dependent (controlled by functional size and characteristics), weight-dependent (controlled by maximum gross vehicle weight), or displacement-dependent (controlled by the nature of the powerplant and its related components). Derivation of the influence coefficients is described, and their application to 15 different vehicles is tabulated. Any given action of weight reduction will probably have secondary changes leading to further weight reduction. Predicted weight reductions by substituting aluminum for steel are given for components for which immediate change is feasible (inner panels of hood and deck lid, bumpers, some castings, wheels, and miscellaneous small parts) and for those not yet feasible (outer panels of hood and deck lid, bumper face bars, cylinder head castings, radiator and its supports, doors, and fenders). It was shown that a curb weight reduction of about 180 lb could be achieved in a 2250 lb vehicle using proven aluminum components; a further decrease of up to 250 lb could be realized by using aluminum components expected to come into production within the next few years. In estimating the weight reductions, it was assumed that the weight-dependent components (suspension, tires) are redesigned to account for the smaller load they need to support.

by Francis E. Kennedy; Frederick J. Hooven  
Dartmouth College, N.H.  
Rept. No. SAE-770805; 1977; 12p 10refs  
Supported by Transportation Systems Center. Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Availability: SAE

HS-024 713

## **WEIGHT-CONSCIOUS AUTOMOBILE DESIGN**

Designs involving weight reduction of four-passenger, five-passenger, and six-passenger cars of the four-pillar sedan type with unitized construction, and using conventional materials and construction techniques are studied and optimum designs recommended. Characteristics conserved include roominess or functional size, safety, durability, and reliability; nonconserved characteristics include a measure of crashworthiness, aerodynamic stability, and protection from noise and vibration. The base vehicles for the car designs are the Fiat 128 four-door sedan, the 1960-1965 Ford Falcon, and a vehicle studied but not produced for the categories of vehicles carrying four, five, and six passengers respectively. Tabulated data include weight breakdowns by vehicle component, weight comparisons between base and optimum designs, and exterior, width, and interior dimensions of the optimum vehicles.

by Frederick J. Hooven; Francis E. Kennedy  
Dartmouth College, N.H.  
Rept. No. SAE-770804; 1977; 11p 3refs  
Supported by Transportation Systems Center. Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Availability: SAE

HS-024 715

HS-024 714

## **OFF-HIGHWAY HYDRAULICS**

Design of the pneumatic and hydraulic systems of off-highway vehicles can be aided by computerized systems analysis, specifically component modeling, dynamic analysis, and computer simulation. In a hydraulic system, a pump delivers flow; pressure is a function of flow resistance. Automotive cooling systems usually use impeller pumps. The system has either a linear actuator or a hydraulic motor; spool valves are usually used, along with a pilot system. Use of an engine speed sensor helps maintain ideal engine operating conditions. Caterpillar's 200-Series Excavators are a good example of the current state of the art in hydraulics; their hydraulic system takes into account all loads imposed on the engine from the multiple pumps as well as other factors affecting engine performance. One alternative to the current petroleum-based hydraulic fluid is a high water base fluid; it is almost certain that there will be a switch to such fluids in the near future. Other predictions of trends include the following: ability to specify component life; quieter hydraulic systems; use of microcomputers to regulate fluid power systems; adaptation of the multi-pass test to ultrasonic or silt filters; a new wiper seal procedure for testing ingress; and development of ferrographic oil analysis methods.

by Wesley A. Waters  
Publ: Automotive Industries Truck and Off-Highway v158 n6  
p28-33 (Apr 1978)  
1978  
Availability: See publication

HS-024 715

## **CARS AND COMPUTERS COME TOGETHER**

Microcomputers are being designed for use in automobiles to monitor combustion and to control precisely carburetion and ignition. Problems in reliability of such a system include the harsh environment (temperature range, vibration, humidity, and electromagnetic interference) and the necessarily complicated system of cabling and connectors. The auto industry has made the conservative and cost-conscious choice of N-channel or NMOS technology for its microcomputer circuitry, which is reliable and available but which lacks the thermal stamina to be under the hood rather than in the passenger compartment. An alternative is the newer CMOS technology. Automakers make a complete check or burn-in of each microcomputer before installation. The system is designed to revert the vehicle to a failsoft or operable condition in case of microcomputer failure. Most devices are of the analog type but some are digital. Automotive designers are interested in electrically programmable ROM's or EPROM's which can be programmed from the outside to fit the particular model of automobile. It is hoped that by the 1980's a microcomputer with a density of 60,000-100,000 components using high-performance MOS (HMOS) technology will be available, and at reasonable cost.

by Clare E. Wise  
Publ: Machine Design v50 n27 p24-6, 28-30 (23 Nov 1978)  
1978  
Availability: See publication



HS-024 716

HSL 79-07

HS-024 716

### **FOIL BEARINGS SHED AEROSPACE IMAGE [ENGINES]**

Foil bearings have long life, high-speed capabilities, potentially low cost, and the ability to operate at temperatures over 1000 degrees F. They belong to the gas bearing family but have a thin, flexible surface replacing one of the rigid surfaces in a conventional gas bearing. The flexibility of the foil allows for easy accommodation of misalignment and geometric shaft imperfections and gives the bearing a higher tolerance to the passage of dirt particles and debris. The tension-dominated type consists of a 1-mil thick metallic strip wrapped around a journal and several guides; this type is being adapted to support the rotor of a Brayton-cycle turboalternator and other high-speed turbomachinery. The bending-dominated type may have either a segmented design (many small foils over the bearing face) or a single-foil design (one large foil supported on a corrugated foil base). The latter type has been tested on the gas generator of an automotive gas turbine. Shaft and foil materials and coatings must be chosen with the high-temperature environment in mind, taking into account the need for high strength, good spring properties, dimensional stability, and oxidation resistance; various possibilities and combinations of materials are listed.

by Richard C. Beercheck

Publ: Machine Design v50 n27 p104-7 (23 Nov 1978)  
1978

Availability: See publication

HS-024 717

### **SAAB'S WELDING AUTOMATION**

At Saab's new plant in Trollhattan, Sweden, all body assembly and tack welding is automated and controlled by minicomputers; final welding is largely carried out by robots. The production sequence of the new Saab 900 model is described in detail. Five different computers are used for different parts of the vehicle, with one additional computer on standby in case of breakdown; they control not only all clamping and welding but monitor welding current. All finishing operations on the bodies are done manually by a system of group working. Such groups are graded by the quality control system, and the higher the grades, the less the supervision.

by Peter J. Mullins

Publ: Automotive Industries v158 n16 p62-5 (Nov 1978)  
1978

Availability: See publication

HS-024 718

### **TRAFFIC CONTROL FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS. TRAINING COURSE INSTRUCTOR'S GUIDE. 3RD ED.**

The basic objective of this training course is to provide information, guidelines and tools which will enable those persons with traffic control responsibilities to create safe and cost effective traffic control procedures for the full range of highway worksite situations. Safety encompasses a concern for motorists, pedestrians, workers, property, equipment and materials. Of critical importance is the need to employ uniform

procedures recognizable by motorists throughout the country and to meet applicable national and local standards and legal requirements. Specific training objectives sought in various portions of the course include providing participants with a basis for: identifying and applying workable concepts and techniques for planning, designing, installing and maintaining traffic control zones in highway construction and maintenance areas; making effective use of the new and improved techniques, procedures and devices which have been developed; monitoring the effectiveness of installations and implementing needed changes; identifying environmental and administrative problems and seeking potential solutions; and assessing the legal and moral consequences of actions and inactions relative to worksite traffic control. Specific areas of worksite traffic control include all road types--including streets, highways and limited access facilities, construction and maintenance activities and utility operations, work locations both in and adjacent to the traveled way, rural and urban environs, and planning, designing, installing, operating, maintaining and removing functions and emergency and disaster situations. The course is designed for presentation to Federal state and local agency personnel and utility and contracting company employees involved in traffic control. Participants may include engineers, technicians and supervisory personnel who have a responsibility for planning, designing, installing, operating and/or inspecting worksite traffic control procedures. The training material includes teaching aids and suggestions for audio-visual aids (viewgraphs, slides or movies).

by Russell M. Lewis; Marshall M. Rich

Byrd, Tallamy, MacDonald and Lewis, Falls Church, Va.  
DOT-FH-11-8525

1978; 575p 156refs

Availability: Federal Hwy. Administration

HS-024 719

### **MOTOR VEHICLE EMISSION INSPECTION/MAINTENANCE INFORMATION KIT**

Inspection and maintenance programs (I/M programs) of motor vehicles support the Clean Air Act Amendments of 1977 and are the responsibility of the states. Implementation schedules and deadlines are to be prepared with the approval and guidance of regional offices of the Environmental Protection Agency. I/M programs must produce at least a 25% reduction in exhaust emissions of hydrocarbons and a 25% reduction in carbon monoxide emissions of light duty vehicles by 31 Dec 1987, compared with what emissions would have been without such a program on the basis of the most recent motor vehicle emission factors. Stringency factors, however, are to be determined by the states. The I/M programs should also provide for regular periodic inspections of vehicles for which emission reductions are claimed, along with maintenance and retesting of failed vehicles. Failed vehicles should be prohibited from using public roads. Appropriate regulations and procedures need to be established, along with minimum specifications for emission analyzers, calibrations of all types on analyzers, and minimum recordkeeping. Either mechanics should be trained or the public should be made aware of which service establishments have approved analyzers. A public relations program is necessary. Tabulated data show the benefits of I/M programs. Both capital and annual costs are considered; in general, I/M programs have been self-supporting by inspection fees and have been cost-effective. Factors influencing costs include type of organization, type and mode of testing, and program

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location. Examples and procedures for cost analyses are given. A suggested model for legislation enabling I/M programs is given which includes the following elements: definitions, purpose, type of program, procedures, staff, implementation schedule, standards for emissions, requirements for vehicle registration, enforcement, applicability and exemptions, public information, repairs, records and review, financing, and severance clause. A tabulated analysis is made of legislation from Arizona, California, Colorado, Connecticut, Nevada, New Jersey, Oregon, and Rhode Island, and of the ordinance from the City of Chicago. Suggestions are made for public relations campaigns, and a listing is given of available materials. A planning schedule is presented for program planning, introductory phase preparation, and introductory phase implementation with preparation for the fully mandatory phase.

Environmental Protection Agency, Office of Mobile Source Air Pollution Control (AW-455), 401 M St., S.W., Washington, D.C. 20460  
Rept. No. EPA-460/3-78-013; 1978; 143p  
Availability: Corporate author

HS-024 720

#### **AN OVERVIEW OF ROADWAY DELINEATION RESEARCH. FINAL REPORT, PHASE 3**

Delineation of the centerline and the outside edges of traveled lanes on paved, two-lane rural roads results in significantly less lateral deviation, less driver stress, and sometimes reduced accident potential. Delineation markings help the motorist, especially at night and in bad weather. The particular system of marking is not important as long as there is a delineation contrast level of 2 or more; special treatments may be needed for critical or nonstandard locations, however. It is difficult to test delineation design by accident data since there are so many variables involved in an accident; experimental research has shown that drivers have only a poor understanding of some widely used striping codes intended to convey important messages. Research is needed in the following areas: cost-effectiveness of maintaining various levels of delineation contrast; optimum stripe-to-gap configuration in both rural and urban situations; drivers' visibility requirements; development of an all-weather pavement delineation system; and improved accident models used as input to cost-benefit analyses of delineation systems. Of the studies reviewed, Task 1-L-3 of the Federal Hwy. Administration has been the most significant.

by Donald G. Capelle  
Alan M. Voorhees and Associates, Inc., 7798 Old Springhouse Rd., McLean, Va. 22101  
DOT-FH-11-8834  
Rept. No. FHWA-RD-78-111; 31L3-032; 1978; 77p 16refs  
Rept. for Sep 1977-May 1978.  
Availability: NTIS

HS-024 721

#### **REGULATORY SIGNS FOR LANE OCCUPANCY AND PARKING. FINAL REPORT**

New designs for parking and lane occupancy signs were developed and tested by having subjects view slides of the signs and judge their meaning. Effectiveness of each design was determined by the speed and accuracy of the decisions. Fixed-schedule, lane occupancy signs were found to be ineffective

and perhaps dangerous, since they gave an unacceptably high error rate and required over twice as long to interpret as equivalent, changeable-message signs. The most successful lane occupancy signs showed occupancy status below the notation "right," "center," or "left" lane. Signs arranged by time gave three-fourths the errors of the equivalent, conventional signs now in use. Signs concerning parking and standing are confusing; redundant messages and the "tow away zone" message should be eliminated.

by Donald A. Gordon  
Federal Hwy. Administration, Analysis and Experimentation Group  
Rept. No. FHWA-RD-78-89; 22K4042; 1978; 79p 5refs  
Availability: NTIS

HS-024 722

#### **THE DRINKING DRIVER AND SOUTH DAKOTA'S IMPLIED CONSENT--THE NEED FOR COUNSEL [LEGISLATION]**

A driver accused of drunk driving and faced with choosing whether or not to submit to a breath test under South Dakota's implied consent law ought to have a reasonable right to consult counsel before making the decision, since the choice has all the characteristics of a critical stage in a criminal proceeding against the accused. However, the Blow decision held that the implied consent statute does not allow an accused a right to counsel; refinements of that decision such as the Peterson case uphold that opinion. A conditional right with constitutional overtones has been guaranteed in both Michigan and New York; Minnesota provides a constitutionally fortified statutory right, and Missouri courts have also held there is a statutory right to counsel tempered by a reasonableness standard, as does Ohio. The reasonableness standard would require that the accused make a binding decision without counsel if counsel could not be reached within a reasonable time.

by James C. Roby  
Publ: South Dakota Law Review v23 p403-26 (Spring 1978)  
1978; refs  
Availability: See publication

HS-024 723

#### **THE SOCIAL PROFITABILITY OF THE SWEDISH SEAT-BELT LAW**

The economic benefits of Sweden's 1975 legislation requiring use of seat belts by front seat occupants of private cars have been estimated, calculating both material and humanitarian gains and losses. The enforcement of the law resulted in an increase of belt users from 40% to 80%, and a decrease in risk of sustaining fatal, serious, or slight injuries by 35%, 50%, and 25%, respectively. Thus, the seat belt law may be said to have reduced the number of deaths by 65, the number of persons disabled by 150, and the number of cases of temporary injury by 2450 in 1975 alone; this corresponds to a material yield of seven Swedish crowns for each Swedish crown invested, or a 1975 material gain of 120 million Swedish crowns. At present, one fifth of all drivers or front seat passengers do not use their seat belts, resulting in 30 unnecessary deaths, 70 un-

necessary disablements, and nearly 1200 unnecessary injuries for a material loss of 65 million Swedish crowns.

by Ernst Jonsson  
 Publ: Journal of Traffic Medicine v6 n3 p40-3 (Sep 1978)  
 1978; 4refs  
 Availability: See publication

HS-024 724

### **FORCES IMPOSED ON THE HIP-JOINT IN CAR COLLISIONS**

Calculated forces corresponding to different car velocities in frontal collisions were imposed on 12 cadaver hip joints to demonstrate the vulnerability of that joint to injury in those who wear loose seat belts. Forces as large as 13,000 N may be imposed on the hip joints of front seat passengers who do not adjust the seat belts correctly. Seven types of injury, five of which were serious, were found in eight of the joints tested. No association was found between the force imposed on the joint and the severity of the injury received. It seems that dashboard design ought to be improved since impact with the dashboard is likely even when seat belts are only slightly loose.

by T. P. G. Doorly  
 Publ: Journal of Traffic Medicine v6 n3 p44-6 (Sep 1978)  
 1978; 8refs  
 Availability: See publication

HS-024 725

### **SIMULATION TECHNIQUES, AN AID FOR THE PREVENTION OF TRAFFIC INJURIES**

The Institute for Road Vehicles TNO (Netherlands) uses both mathematical and experimental simulation techniques to test both passive and active safety belt systems as aids in preventing traffic injuries. Experimental studies using dummies instead of human beings may be either full scale or by means of a less expensive crash simulator; cameras, sensors, data processing instruments, and a computer are needed. In mathematical simulation, a computer is used to process the formulas representing the relationships among the various crash factors; the mathematical models are based on Newton's Law, an equation of motion. Experimental simulation has preceded theoretical simulation; the two approaches complement rather than replace each other.

by A. C. Bacchetti; B. Boesmans  
 Publ: Zeitschrift für Verkehrssicherheit v24 n3 p93-8 (Autumn 1978)  
 1978; 4refs  
 Summaries in German and French.  
 Availability: See publication

HS-024 726

### **TRAFFIC SAFETY PLANNING ON SCHOOL SITES**

Selection of a school site should be based on present and future needs, including school size and land area needed, rather than simply on cost. Adequate physical space must be provided for all modes of transportation used on the school site. The routes provided for the basic components of the traffic pattern should be separated as much as possible from each

other. Types of transportation areas to be considered include the following: school bus zones, parent pick up and drop off zone, parking for faculty, students, and visitors, pedestrian and bicycle routes, service roads, and access by emergency vehicles. Traffic control devices should conform to the Michigan Manual of Uniform Traffic Control Devices; in addition, the proper road agency should review both the site and plans for the school. Safety factors in areas adjacent to the school site include land use or zoning, and arrangement of roadways and pedestrian walks. Diagrams show how existing school sites can be made safer by simple modifications of roadways or of flow of traffic and pedestrians.

Michigan Section Com. on Traffic Engineering Around Schools  
 Publ: ITE Journal v48 n8 p22-9 (Aug 1978)  
 1978; 3refs  
 Section Technical Award 1978.  
 Availability: See publication

HS-024 727

### **USAGE AND EFFECTIVENESS OF ADVISORY SPEEDS. REVIEW. AN ITE [INSTITUTE OF TRANSPORTATION ENGINEERS] INFORMATIONAL REPORT**

A report by the ITE (Inst. of Transportation Engineers) Technical Council Com. 41-M is summarized on the use in the U.S. of advisory speed plates to supplement traffic warning signs and the effectiveness of the displays. The Committee sent a survey questionnaire to the agency responsible for traffic engineering in each state. The responses received from 40 states were analyzed qualitatively, to indicate the general feelings of the responding agencies, and quantitatively, to establish trends and to test the significance of the various parameters of usage and effectiveness. Considerable variation was observed in the use of advisory plates on warning signs according to the actual sign used and according to use of the same sign by different states. The curve warning sign had the highest percentage (53%) of use. The use of plates on advisory signs tends to be significantly the same within functionally similar groups, except for the construction-related group of signs (construction ahead, men working, blasting zone). Several innovative ideas for advisory-speed devices were provided in questionnaire responses including nonstandardized signs and atypical applications. Of the responding states, 78% indicated no deviation from the uses stated by the Manual on Uniform Traffic Control Devices. Positive replies, indicating satisfaction with the devices, were received from 41.2% of the states. The same percentage had some reservations, and 17.6% responded negatively. Reservations included overuse of devices, setting of too low speeds, and disregard of devices by the average motorist. Nationwide standardization was suggested as a possible solution. The greater satisfaction was indicated by states that use more sophisticated speed determination methods and have fewer other agencies operating under conflicting policies.

ITE Technical Council Com. 41-M  
 Publ: ITE Journal v48 n9 p43-6 (Sep 1978)  
 1978; 1ref  
 Availability: See publication

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HS-024 730

HS-024 728

### **CHARACTERIZATION STUDY OF AN ELECTRIC MOTOR-TRANSMISSION SYSTEM FOR ELECTRIC VEHICLES. TECHNICAL REPORT**

A unique electric transmission concept for use in automotive vehicles is described, consisting of two DC traction motors in tandem. The device eliminates the requirement of intermittent current supply at low speeds, and is shown to be superior to conventional electric-motor drives in efficiency, flexibility of torque-speed requirements, control, and adaptability to regenerative braking. The electric motor-transmission can operate in the differential, the single-motor, or the additive mode, producing both forward and reverse speeds while covering the entire spectrum of torque, speed, and power required by an automotive vehicle. A detailed study of a 7.5 Kw model was performed, providing performance data, current drain, output, efficiencies, and other relevant system characteristics. Based on these data, a preliminary design is formulated including estimates of size, weight, and cost. A catalog of specifications for power ratings ranging from 3.7 Kw to 15 Kw is included, enabling the automotive designer to select the most appropriate unit for a specific vehicle. Problem areas included the electrical and mechanical consequences of high speed operation and switching problems, particularly transition to and from the additive mode. Further work is recommended on such problems as commutation, current transfer, and brush tracking. Recommendations are made for advancing the technology of high-speed DC machinery and a development program for the construction and testing of an appropriate electric motor-transmission prototype for demonstration purposes.

by A. Marcus; O. Pinkus  
Mechanical Technology Inc., Electrical Engineering Dept., 968  
Albany-Shaker Rd., Latham, N.Y. 12110  
DOE-EY-76-C-02-2835  
Rept. No. COO/2835-2; 1977; 108p 9refs  
See also HS-024 739.  
Availability: NTIS \$6.50 paper copy, \$3.00 microfiche

HS-024 729

### **CARBON MONOXIDE AUTOMOBILE EMISSIONS MEASURED FROM THE INTERIOR OF A TRAVELING AUTOMOBILE**

During a procedure to monitor carbon monoxide (CO) concentrations inside a traveling car on lightly-traveled sections of an Interstate highway (from Chicago to New Orleans, 18 to 20 Mar 1977), it was discovered that CO emissions from individual passing vehicles produced clearly-defined peaks on a strip chart recorder (measurements made using a gas filter correlation monitor). Subsequent measurements on 760 vehicles (on Interstate 8 from New Orleans to San Diego, 27 Mar to 2 Apr 1977) showed a surprisingly wide variation in CO concentrations. These vehicles were divided into five classes based on the maximum increase in CO concentration inside the monitoring vehicle, as follows: class 1, maximum increase less than 0.05 ppm, all 1975, 1976, or 1977 models lightly loaded (less than half of the designed load); class 2, maximum increase between 0.05 ppm and 0.5 ppm, mostly 1970 through 1974 models and some newer cars carrying heavy loads (100% or more of the designed load); class 3, maximum increase between 0.5 ppm and 5 ppm, including older cars and some heavily-loaded newer vehicles such as motor homes and pickup trucks; class 4, maximum increase between 5 ppm and

30 ppm, all heavily-loaded vehicles, most of them older than 1970; and class 5, maximum increase greater than 30 ppm, two vehicles (a pickup truck pulling a four-horse trailer, and a no-brand fuel-oil delivery truck (CO of 45 ppm)). Class 1 and class 2 vehicles grouped together represented 76% of all vehicles observed and contributed 12% of the total CO. Class 4 and class 5 combined represented 3.3% of the vehicles and contributed 45% of the total CO. Although most drivers are not exposed to toxic doses of CO, under certain circumstances (heavily-loaded vehicles, increased road grade) the potential exists to exceed the Federal Ambient Air Quality Standards (9 ppm for 8 hr, 35 ppm for 1 hr).

by Lucian W. Chaney  
Publ: Science v199 p1203-4 (17 Mar 1978)  
1978; 5refs  
Availability: See publication

HS-024 730

### **AUTO CERTIFICATION TESTING**

The step-by-step procedures in Ford Motor Co.'s emissions testing program are described, wherein representative vehicles are tested for the forthcoming model year to ensure that they meet Federal emission standards. Most of the testing is performed at laboratories in Allen Park and Dearborn, Mich. during around-the-clock operations, six to seven days a week. There also is a high-altitude test lab in Denver, Colo. The actual emissions certification effort for the next model year starts a full year ahead of the model year for which the cars are being tested. Around July of each year, the company submits to the Environmental Protection Agency (EPA) a Part I Application which provides detailed descriptions of the complete product line projected for the model year. Planned production volumes for each vehicle model, and a detailed description of each engine to be built, all emission control systems, and all emissions test facilities must also be included. From this application, the EPA specifies two fleets of mandatory test vehicles, one of about 90 vehicles (in Ford's case) to be run for 50,000 mi over a prescribed test course (durability data fleet) and the other of 100 to 120 vehicles (for Ford) to be tested for 4000 mi and representing virtually every vehicle-engine combination Ford plans to produce (the latter fleet subsequently tested at EPA lab). The actual certification test is an eight-stage procedure on which the company spends around \$40 million annually. Ford runs the vehicles some 6 million test miles through about 7500 tests on dynamometers and on the test track. The work amounts to some 250 man-years. Important in the certification process is the emissions deterioration factor as the vehicle moves from low to high mileage. This is determined by taking a least-square fit of the emissions data generated by the 50K vehicles and dividing the projected 4000-mi emissions level into the 50K-mi level for each of the major pollutants. Compliance with EPA standards is determined by multiplying the 4K emissions level by the deterioration factor. Once testing is completed, a Part II Application with all test data and a request for Certificates of Conformity is submitted to EPA.

by William A. McConnell  
Publ: Environmental Science and Technology v12 n4 p393-6  
(Apr 1978)  
1978; 1ref  
Availability: See publication

HS-024 731

HS-024 731

**BICYCLE COMPLIANCE TEST MANUAL.  
REGULATORY DOCUMENTS: FRN JULY 16, 1974,  
FRN NOVEMBER 13, 1975, FRN JANUARY 28, 1976**

This manual describes the test equipment, precautions and procedures for performing compliance tests on bicycles as specified in the Federal Register, 28 Jan 1976. The compliance tests are classified as visual, simple, and laboratory types. Illustrations and photographs of some of the test arrangements, and drawings and photographs of some of the test equipment are provided. A general compliance test flow diagram is given. Any bicycle subject to the bicycle regulation shall meet its requirements in the condition in which it is offered for sale to consumers; any bicycle offered for sale to consumers in a disassembled or partially-assembled condition shall meet these requirements after assembly according to the manufacturer's instructions.

by Kenneth W. Edinger  
Consumer Product Safety Commission, Product Standards  
Div., 5401 Westbard Ave., Washington, D.C. 20207  
Rept. No. PB-283 274; 1976; 108p 16refs  
Sponsored mainly by National Bureau of Standards.  
Availability: NTIS

HS-024 732

**PASSENGER CAR FUEL CONSERVATION. FINAL  
REPORT**

Detailed information on the effect of personal driving habits and maintenance of engine and tires on passenger car fuel consumption was sought through highway test operations. Test operations included the following measurements of fuel consumption: a sample of 93 drivers for operation under specific sets of urban driving conditions; a sample of 22 passenger cars for operation before and after a major tuneup; a single passenger car for both low and high ranges of acceleration rates and for stop cycles, stop-cycle frequencies, and for various road design details; and a sample of 18 passenger cars for 100% and 80% of a given tire inflation pressure. All fuel consumption measurements were made with a meter capable of measuring fuel consumption to the nearest 1/1000 of a gallon. It was concluded that although most drivers are normally economical in the use of fuel, there would be a substantial saving in fuel consumption for stops in urban areas if drivers would not jab the accelerator suddenly as many often do. Engine tuneups save fuel only if the engine is out of adjustment or if one or more of the engine parts are malfunctioning. Reduced tire pressures result in increased fuel consumption for passenger cars with either radial or bias ply tires. For the same tire pressure, radial tires result in less fuel consumption than do bias ply tires. There is no difference in passenger car fuel consumption after dark compared to daylight operation. Much less fuel is consumed for hot starts and hot engine operation than for cold engine operation.

by Paul J. Claffey  
Paul J. Claffey, Consulting Engineers, 26 Grant St., Potsdam,  
N.Y. 13676  
DOT-FH-11-8490  
Rept. No. FHWA-PL-77009; PB-265 369; 1977; 245p 7refs  
Availability: NTIS

HSL 79-07

HS-024 733

**CHILD AUTO RESTRAINT DESIGN PRINCIPLES**

The anatomical considerations and general principles of occupant restraint in the car crash environment are presented, with emphasis on the protection of the child; design criteria and typical performance problem areas in child restraint systems are discussed. Careful consideration must be given to anatomical and size factors when designing a child restraint. The less developed the child's physical structure, the more important it is to distribute restraint loads more evenly over large areas of the body. These considerations are complicated enormously by the fact that there are no impact tolerance data on children available for evaluation of child restraints. The designer must provide effective solutions to the interfacing of the child restraint system with a variety of car interiors if widespread use is to be made of the design. It generally is accepted that a restraint system which places its occupants facing the rear with respect to the direction of deceleration, and supports the entire body surface, is the most effective method of providing protection from impact injury. A system which employs a load-distributing surface in front of a forward-facing occupant would generally be considered the next most effective system. The third basic method of restraint is a belt harness system. Child restraint design criteria are structural integrity, dynamic interaction with the adult seat, proper use of the adult restraints to secure the child seat, load distribution, limitation of body motions, comfort, useability, and cost. Common problems in the dynamic performance of prototype child restraints are structural collapse and rupture, concentrated loading of the occupant, and high occupant accelerations due to harness and padding inadequacies. The present child restraint performance standard, Federal Motor Vehicle Safety Standard 213, specifies performance in terms of static loading of the restraint system. However, some restraints which meet the static test requirements have been shown to collapse structurally under dynamic loads produced in a 30 mph, 20 G crash simulation. Proposed revisions to FMVSS 213 include dynamic tests. Tests at several angles in the frontal quadrants are recommended, as well as under conditions of ejection from a child seat, including vehicle rollover. Since child restraint systems are optional after-market equipment, standards for these devices must ensure availability, simplicity of use, and low cost, in order to encourage widespread usage.

by John W. Melvin; Richard L. Stalnaker  
Publ: Journal of Products Liability v2 p43-57 (1978)  
1978; 12refs  
Presented at Southeastern Conference on Safe Products  
Design and Failure Analysis, Durham, N.C., 18-19 Nov 1977.  
Availability: See publication

HS-024 734

**A PROPOSED PROCEDURE FOR PREDICTING  
PERFORMANCE ASPECTS OF ROADWAY  
LIGHTING IN TERMS OF VISIBILITY**

A practical method is described for specifying the roadway lighting required for the performance of specific driving tasks. The method was developed from extensive studies of the visibility of realistic and simplified two-dimensional targets under different systems of fixed roadway lighting, using a 15-to-1 scale model simulation in which all physical parameters could be carefully controlled. An internationally agreed-upon quantitative method was utilized for evaluating visibility and performance (effective visibility level), as described in a report on

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visual performance by the Commission Internationale de l'Eclairage. Using a particular study in which the effective visibility level of the relevant target was measured, an illustration is provided of a method for combining visibility requirements with the visibility from a given lighting system to give a task-performance probability index for that system. Factors included in the method include disability glare factor, and calculable physical parameters such as roadway and target luminances. The resulting index may be used to evaluate the relative merit of different roadway lighting situations and could serve as a performance standard for roadway lighting.

by O. M. Blackwell; H. R. Blackwell  
Publ: Journal of IES v6 n3 p148-66 (Apr 1977)  
1977; 17refs  
Availability: See publication

HS-024 735

#### **AVERAGE SPEED CONTROL AND ENERGY CONSERVATION ON LIMITED-ACCESS HIGHWAYS**

A relatively simple procedure is proposed for controlling the average speed of vehicles on limited-access highways for the purpose of conserving energy; fuel savings that can be achieved by strict adherence to a given speed limit are estimated. The proposed method for speed control is particularly well-suited for toll roads where times of entry and exit can be recorded and used to determine the average speed maintained by a vehicle between the entry and exit locations. Currently, on the New York State Thruway as an example, the operator determines the toll to be paid from the distance travelled on the Thruway. The toll could be calculated from the distance travelled and the average speed (determined by elapsed time). Motorists observing the speed limit would pay only the distance toll, whereas speeders would pay distance and speed tolls. Equations are presented for estimating the amount of fuel that can be saved by strict adherence to a given speed limit, taking into consideration the aerodynamic drag and rolling resistance forces that act on a vehicle during constant-speed motion. Using various sources for average highway speeds in the U.S., and total mileage travelled in 1976 on the New York State Thruway, it is estimated that between 12.7 million and 33.7 million gal of fuel could be saved yearly by Thruway motorists if they all adhered to the 55 mph speed limit. Another benefit of compliance with the speed limit would be fewer accidents.

by Cynthia M. Bruso; J. Richard Shanebrook  
NSF-SMI76-83639  
Publ: Journal of Environmental Systems v8 n1 p13-9 (1978)  
1978; 16refs  
Availability: See publication

HS-024 736

#### **EXPERIMENTAL EVALUATION OF A PORTABLE ENERGY ABSORBING SYSTEM FOR HIGHWAY SERVICE VEHICLES. PHASE 1. FINAL REPORT**

A portable energy-absorbing system has been designed and fabricated, and tested on the rear of a standard 14,000-lb highway service vehicle used in maintenance operations. The system was designed to have the capability of absorbing most of the energy dissipated in a high-speed collision between an automobile and the highway service vehicle, so that the accelerations and acceleration rates to which the vehicles are

subjected are within guidelines specified by the Federal Hwy. Administration. The design of the energy-absorbing system involves three components: the service-vehicle guidance frame, the energy-absorbing pipes, and the impacting plate assembly. Four full-scale crash tests were conducted by Calspan Corp. (subcontractor) to evaluate the structural adequacy, impact severity, and vehicle trajectory of the system. (The individual test reports are appended). Results of the testing program demonstrate that implementation of this system would provide protection for both the motoring public and the service personnel engaged in maintenance operations. The system would also offer effective protection for the equipment used in highway maintenance and repair projects. Of particular value would be its implementation during highway line-stripping operations which are conducted almost daily. The energy-absorbing system would provide immediate temporary protection during short-term repair or clean-up operations, such as repair of a Fitch sand-filled barrel system. The energy-absorbing system is inexpensive to build (about \$2000), very inexpensive to repair, is compact, and designed for use on New England's curved and hilly roads.

by John F. Carney, 3rd.  
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CT.-HPR-402  
Rept. No. FHWA-CT-RD-402-1-77-3; PB-283 075; C.E.-77-109; 1977; 126p 28refs  
Rept. for Dec 1975-Jan 1977. Prepared in cooperation with Federal Hwy. Administration.  
Availability: NTIS

HS-024 737

#### **BICYCLE-MOTOR VEHICLE ACCIDENTS, STATISTICS AND STRATEGIES FOR REDUCTION. BICYCLE REPORT 2 [BALTIMORE, MARYLAND]**

As part of the Unified Transportation Planning Prog. for the Baltimore Region, an examination is presented of recent bicycle-motor vehicle accident statistics for the Region, in the context of available national statistics. Strategies are suggested for reducing the Region's bicycle-motor vehicle accident rate. According to data from Maryland State Police accident records, there were 1082 reported bicycle-motor vehicle accidents in 1976, vs. 1006 in 1975 (a one-year increase of more than 7%). In both 1975 and 1976, 60% of the accidents occurred in Baltimore City. About one-third of the accidents in both 1975 and 1976 involved cyclists between 10 and 14 years of age, the age group with the highest number of accidents. Compared to a figure of 9% in a 1971 and 1972 study, 16% of the cyclists involved in accidents in 1976 were age 20 or over. Nearly two-thirds of the accidents happened in or near driveways or intersections. Cyclist or motorist actions were listed as the accident causes in a large majority of cases in both 1975 and 1976. To reduce the bicycle-motor vehicle accident rate, the following strategies are recommended: involve both drivers and cyclists of all ages in effective bicycle safety education; provide bicycle safety education for children and teenagers in the schools (extending into high school) and for adults through existing groups (e.g. churches, clubs, places of employment suited to bicycle commuting); enforce laws designed to enhance bicycle safety and to govern relations between cars and bicycles; properly design and maintain bikeways which can contribute to safer cycling conditions; consider bicycles in the construction and maintenance of non-bikeway roads; and revise traffic laws that do not promote safety or that create dangerous ambiguities (areas needing attention include right-of-way conflicts

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between bikes and motor vehicles, the child cyclist, the legal status of mopeds, and reflector requirements).

by Ganie DeHart

Regional Planning Council, Baltimore Regional Bikeways Study, 701 Saint Paul St., Baltimore, Md. 21202  
1978; 53p refs

Sponsored by Maryland Dept. of Transportation, Regional Planning Council (Baltimore), and Federal Hwy. Administration.

Availability: Corporate author

HS-024 738

### **AN OVERVIEW OF A BULK GASOLINE DELIVERY FIRE AND EXPLOSION. SPECIAL INVESTIGATION REPORT**

A bulk-gasoline delivery fire and explosion which occurred on 31 Aug 1976 near Gadsden, Alabama is described, and an analysis presented of procedures for implementing safeguards against fire and explosion during gasoline deliveries at service stations with aboveground storage tanks. The accident in question involved a fire which erupted while a truck driver was making a gasoline delivery from his tractor-semitrailer (tank) into an aboveground storage tank at a service station; the fire and explosion resulted in the deaths of three firefighters, injuries to 11 other firefighters and 17 bystanders, and an estimated \$4,000,000 in losses. After participating in and reviewing the investigation by the State of Alabama Fire Marshal's Office, the National Transportation Safety Board undertook a special investigation to determine how this delivery accident could have resulted in such large losses in view of existing safety codes and standards, and to determine if these circumstances represent broader safety problems affecting gasoline transportation safety nationwide. The investigation disclosed that important safeguards prescribed in safety codes and standards had not been implemented at Gadsden, that these circumstances are not unique to the Gadsden accident, and that both safeguards and the administration of safety codes and standards can be improved to reduce risks of future gasoline delivery fires and explosions. Recommendations made to the Fire Marshals Assoc. of North America, the American Assoc. of Motor Vehicle Administrators, and the Underwriters Labs., Inc. include providing officials with guidelines for identifying recognized hazards at service station facilities; developing a procedure for determining which service stations constitute an unusual safety risk and for informing local firefighters of these risks; and studying ways of assuring periodic inspection of safety equipment on hazardous material tank vehicles. It was recommended that the Underwriters Lab. establish a procedure for discouraging misuse or unsafe modification of UL-listed equipment and that the UL safety standard for aboveground storage tanks for Class I liquids be improved to provide engineering safeguards, other than pressure relief devices, during bulk delivery of these liquids.

National Transportation Safety Board, Bureau of Technology, Washington, D.C. 20594

Rept. No. NTSB-HZM-78-1; PB-283 769; 1978; 30p refs

Availability: NTIS

HS-024 739

### **AN ADVANCED ELECTRIC MOTOR-TRANSMISSION FOR ELECTRIC VEHICLES. DEVELOPMENT PLAN. TECHNICAL REPORT**

A plan of action is presented to design, fabricate, and test an advanced all-electric motor-transmission system suitable for use in electric vehicles (EV's) of the future. This system is based upon a Mechanical Technology Inc. (MTI) development and invention. MTI proposes to demonstrate, by means of a full-sized laboratory model, the capability of this unique and highly-efficient, variable-ratio electric motor-transmission system. This development plan presents the demonstration portion of previous related work which had reduced the concept to practice and characterized the system operation, performance, and capability for an advanced EV propulsion system. The MTI All-Electric Motor-Transmission System, which consists of two adjustable-speed DC traction motors connected in tandem, eliminates the need for and losses in the high-pulse current electronic chopper control and mechanical transmission. In a direct-drive mode, the MTI transmission can make use of, either singly or in mechanical tandem, the maximum efficiency capability of an individual drive motor unit. The application of the MTI transmission will provide electric propulsion systems of the future with the following advantages: improved efficiency and capability for an increased vehicle range, a smooth-operating and driveable control system, a potential reduction in vehicle weight for a given performance envelope, increased reliability of the propulsion system, and an advance in the design and development of high-speed DC machinery suitable for EV applications.

by A. Marcus

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DOE-EY-76-C-02-2835

Rept. No. COO-2835-3; 1977; 60p 2refs

See also HS-024 728.

Availability: NTIS \$5.25 paper copy, \$3.00 microfiche

HS-024 740

### **FRONT WHEEL DRIVE STEERING AND SUSPENSION**

As cars have become smaller and lighter in order to meet Federal fuel economy standards, U.S. automakers have had to improve the ride of these cars, which are more susceptible to road irregularities and crosswinds, in order to maintain customer satisfaction. Each of the different engineering approaches taken by General Motors Corp., Ford Motor Co., Chrysler Corp., and American Motors in suspension and steering systems are discussed. The systems described include front-wheel drive, fully-independent suspension, automatic load leveling, MacPherson struts, four-bar links, specific suspensions, and isolated suspension members. General Motors is presenting "X-body" cars, with unitized body and front wheel drive, powered by inline 4 or V-6 engines mounted transversally, and featuring MacPherson struts with a sway bar and a compound crank axle with trailing arms and a Panhard rod. Riviera, Toronado and Eldorado cars will have front wheel drive, and front torsion bar suspension, with electronic level control. Ford Motor Co. will equip the Fairmont/Zephyr and Mustang/Capri with MacPherson struts and a four-bar link. Particular attention is paid to controlling noise, vibration and harshness (NVH) by the use of bushings, insulators, and dampeners. The Mustang has a new suspension featuring



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NVH, corrosion control, and "zero-scrub" radius (zero degrees caster) to reduce road shock and to prolong tire life. The LTD has a new front suspension and stiffer shock absorbers. Chrysler's Newport and New Yorker, and Dodge's St. Regis are shorter and lighter, with an option called "Open Road Handling" which provides heavy-duty shocks and torsion bars, rear sway bar, and leaf springs, and "Firm-Feel" power steering. Omni/Horizon has ISO-strut (MacPherson) with a sway bar and rack and pinion steering, "compliant" bushings for NVH, and a rear suspension with semi-independent trailing arm and an integral sway bar. American Motors has made a front sway bar standard on the Spirit Liftback, Pacer and Concord, and has offered an option on AMX and Spirit Liftbacks called "rally tuned suspension" (front and rear sway bars, strut rod bushings, and rear spring isopad clamps).

by John McElroy

Publ: Automotive Industries v158 n16 p36-41 (Nov 1978)  
1978

Availability: See publication

HS-024 741

## **IS CONGRESS CHANGING ITS TUNE? [FEDERAL MOTOR VEHICLE REGULATIONS]**

According to recent comments by three Democratic congressmen from Michigan, Reps. John D. Dingell, James J. Blanchard, and William M. Brodhead, a new, more favorable attitude toward the auto industry is presently developing in the U.S. Congress. The advocates of tougher motor vehicle regulations are running into some independent and sometimes angry opposition in Congress for the first time. This about-face in Congress has already manifested itself in the reasonable revision of the truck mileage standards last spring, in the House amendment to withhold funds from the National Hwy. Traffic Safety Administration for 1979 air-bag research, and in the House's successful effort last year to defeat the Administration's air pollution standards for cars. This new attitude probably also will be reflected in future hearings on the periodic comments from the Federal Trade Commission about breaking up the auto industry, as well as on the issues of air bags, fuel economy averages, diesel engines, pollution standards, and the unfair treatment of U.S. auto imports by Japan and other nations. A major factor affecting this new Congressional attitude concerns the bias and lack of objectivity exhibited by some of the current regulators in the Dept. of Transportation and the Environmental Protection Agency. Another factor is the growing awareness of the importance of the employment and purchasing power of the auto industry to the nation's economy. The three Michigan congressmen are increasingly concerned about the impact of overregulation on their constituent auto workers, and auto companies. All three representatives credited the auto companies with doing a better job of presenting their cases to Congress and to the public.

by Joseph M. Callahan

Publ: Automotive Industries v158 n16 p47-51 (Nov 1978)  
1978

Availability: See publication

HS-024 742

## **MPG'S: FINDING WHAT YOUR CAR WILL AND WON'T DO. SYSTEMS CENTER HELPS DOT PUSH ENERGY CONSERVATION [DEPARTMENT OF**

## **TRANSPORTATION, TRANSPORTATION SYSTEMS CENTER]**

When the Dept. of Transportation was mandated by Congress in Dec 1975 to set up fuel economy standards for all passenger vehicles for 1981 to 1984 and for nonpassenger vehicles up to 10,000 lb for 1980 to 1985, the Secretary of Transportation turned to Transportation Systems Center (TSC) for analysis and information. Among its 150 ongoing transportation projects, TSC has performed research on manufacturing costs, corporate finance, costs paid by consumers, technology and engineering, product marketing, and the national economy. Methods to improve fuel economy were studied, such as reduction of auto weight, use of substitute materials, improvements in engines and transmissions, reduced acceleration, and alternative engines. Also analyzed was the ability of the auto industry to respond to the car fuel standards in the short time allotted. Based on TSC's analysis and other information, the Secretary announced in Jun 1977 an average of 22 mpg for new cars in 1981, 24 mpg for 1982, 26 mpg for 1983, and 27 mpg for 1984. Now TSC has been asked to assist in reevaluating the 1984 and 1985 standards and to help set standards for 1986, with the purpose of determining whether the average mpg of new cars can be raised even more without upsetting the hoped-for equilibrium between technological and economic forces during the next eight years. Based on TSC findings from a study of the economic status of one of the major auto companies, DOT decided to ease the proposed 1980 and 1981 fuel economy standards for light trucks. In order to measure engine performance precisely and realistically, TSC has just built a \$2 million engine research lab and has the following projects scheduled for the end of 1978, 1979, and 1980: reports on alternative fuel economy standards for passenger cars in model years 1984 to 1988, reports on potential fuel economy standards for passenger cars up to 1990, analyses for setting fuel economy standards for light-duty trucks and vans for 1982 through 1984, and assessment of the impact of fuel economy standards on the financial structure of the motor vehicle industry.

by Jerome Sadow

Transportation Systems Center, Office of Public Information,  
Cambridge, Mass.

Publ: Transportation USA v5 n1 p10-3 (Fall 1978)  
1978; 1ref

Availability: See publication

HS-024 743

## **THE DOUBLE NICKEL CHALLENGE. TEST SHOWS TRUCKERS THAT SLOWER DRIVING SAVES FUEL**

The "Double Nickel Challenge", a test conducted by the Dept. of Transportation (DOT) to gauge the relative fuel efficiencies of large trucks operated at 55 mph ("the double nickel" in CB jargon) and at various higher speeds, involved 32 contenders who rallied at the 7 1/2-mi, high-speed, oval test track of the Ohio Transportation Res. Center in East Liberty, Ohio, on 1 Aug 1978. The participants were independent truck drivers from 18 states, volunteers who accepted the DOT invitation to test their rigs in defense of the claim by some in the trucking business that "faster is cheaper". The results of the three-day tests showed that 26 rigs had fuel savings of up to 27% at 55 mph over runs made at higher speeds. The other six rigs, however, got from 1.6% to 9% better mileage at speeds between 59 mph and 64 mph. DOT estimates that if 85% of the driving public obeyed the 55 mph speed limit, 15 million gal of



HS-024 744

HSL 79-07

gasoline could be saved a day. In addition to fuel savings, the 55 mph limit means lower maintenance and other costs, and is significant in reducing traffic fatalities.

by Robert M. Beasley  
Department of Transportation, Office of Public and Consumer  
Affairs, Washington, D.C. 20590  
Publ: Transportation USA v5 n1 p18-9 (Fall 1978)  
1978  
Availability: See publication

HS-024 744

### CHILD RESTRAINTS

Five misconceptions commonly held by adults are enumerated concerning child protection in automobiles, particularly child-restraint system usage. Each year in the U.S. about 1000 children five years of age and younger are killed in traffic accidents, and 100,000 in the same age group injured. The main reasons for these statistics are the low usage rate and high rate of misuse of child restraints. In correcting five false statements regarding child protection in automobiles, it is pointed out that a child riding in an automobile is not safe if he is held tightly on an adult's lap; belts designed for adults do not work as well for smaller passengers but are better than no restraint; many infant carriers do not give much protection in a car, and household child seats or other carriers not designed to withstand the stress and absorb the shock of an accident are useless and even dangerous in cars if they break during a crash and expose sharp edges; any child restraint must be installed properly; and a child's body may be resilient, but his head is particularly vulnerable (77% of all injuries to children in car accidents involve the head). Child seats that just hook over the back of a seat are prohibited from sale; seats often are not anchored securely and may come loose during a crash. Regulations require that restraints be attached to a vehicle lap belt, as a minimum; equally important, the child must be fastened into the restraint. General specifications are supplied for child restraints according to the child's age and weight: infant carriers, child seats with shields or belts, and child harnesses.

Publ: Transportation USA v5 n1 p24-5 (Fall 1978)  
1978  
At head of title: Searchlight on Safety.  
Availability: See publication

HS-024 745

### HYDROGEN BUS COULD ALSO HEAT ITS OWN GARAGE

Mercedes-Benz' Physical Res. Dept. has converted several vans and buses to run on hydrogen fuel by replacing the vehicles' gas tanks with containers of metal hydrides which soak up hydrogen and then release the gas when heated to power the engine. A small, hydrogen-fueled city bus with a slightly modified 2.3 L, 4-cylinder engine can do 120 mi on one filling. In fleet operation, a bus would be refueled during the night at the terminal; it might take 45 min to refill hydride containers with pressured gas. One big problem with this fuel technology is weight. Mercedes' basic unit, which holds 12 gal of hydrogen, weighs 440 lb vs. 65 lb for a tank of gasoline with same energy content. Although another drawback is limited range, because of the need for refueling at special depots, hydrides store up to six times more energy than a lead-acid

battery. It is estimated that it would cost around \$1500 to convert a standard city bus to hydrogen, but there are savings that would make the switch economical in the long run. Massive quantities of hydrogen could be produced by water electrolysis, perhaps powered by solar energy. The vehicles themselves could pay back energy as they refuel. The waste heat released as the hydrides absorb hydrogen, and the warmth already in the tanks from engine combustion during the day, could be used to supply a thermal power station at the bus terminal that would feed the electricity grid. There is also the possibility of extracting hydrogen from natural gas or coal, using a selective absorption process that would leave the hydrocarbon mixture combustible enough for domestic or industrial use. For domestic purposes, hydrogen from a separation plant could be piped to houses and stored in a hydride tank. A closed-cycle "hydrogen homestead" could recycle waste heat generated by charging hydride tanks, as well as heat generated overnight by charging a hydrogen-fueled family car from a separate tap. Mercedes already has an experimental car running on a mixture of hydrogen and gasoline. The modified 280E sedan carries a lightweight 110-lb hydride. With 4% hydrogen in the fuel, gasoline consumption is reduced by 25% without affecting range or top speed (115-mph) and with substantial reduction of emissions.

by David Scott  
Publ: Popular Science v213 n6 p72-3 (Dec 1978)  
1978; 2refs  
Availability: See publication

HS-024 746

### RENT-A-BAY. COMING TREND IN D.I.Y. [DO-IT-YOURSELF] AUTO REPAIR?

Rent-a-bay operations, where a car owner can rent garage space and equipment to do his own repairs, are now in business at about 150 locations in the U.S., many of them in Mobil (90) and Shell (19) self-service stations. They are part of a self-service gas-station operation, having two or three bays, with a hydraulic lift in at least two of them. The basic items available in each Mobil self-repair station are a battery charger, static (bubble) wheel balancer, tire-changing machine, impact wrench, air chisel, lube gun, oil-changing equipment, and a small tray of hand tools. The main jobs usually done are oil and filter changes, chassis lube, exhaust-system work, and sometimes brake and tuneup work. Mobil charges \$3/hr for a bay. Special tools, such as the tire changer and bubble balancer are extra (\$2 apiece). Unlike Mobil's rent-a-bay operations, which are spread across the country, Shell's do-it-yourself garages are located mostly in the Midwest. Shell's garages are similar in operation to Mobil's, two or three bays in a self-service gas station. The rent-a-bay business is growing, mainly because it saves the customer money, but also because most rental bays are open evenings and weekends when the professional garages are closed.

by Ray Hill  
Publ: Popular Science v213 n6 p112-4, 148 (Dec 1978)  
1978  
Availability: See publication

July 31, 1979

HS-024 750

HS-024 747

### THE EVALUATION OF A SEMI-ANECHOIC CHAMBER USED FOR SMALL-ENGINE SOUND ANALYSES

The acoustical response characteristics of Kohler Co.'s semi-anechoic chamber used for analysis of its small-engine line are evaluated by an analysis of the chamber as a system and by an analysis of the room's sound-absorptive wedges. The room's inside dimensions (wedge-tip to wedge-tip) are 35 ft (10.7 m) long by 14 ft (4.3 m) wide by 9 ft (2.7 m) high. The walls and ceiling of the chamber are lined with 24-in (610-mm) deep, fabricated anechoic wedges. According to the manufacturer's product data sheet, the wedges have a cutoff frequency of 150 Hz. (Above 150 Hz, wedges are supposed to have a normal incidence sound energy absorption in excess of 99%, which corresponds to a pressure reflection of less than 10%.) Although it was originally believed that all spectral components of a narrowband analysis, down to the wedges' cutoff frequency, could be accepted with confidence, some preliminary testing in the chamber produced contradictory results. It is concluded that in any semi-anechoic chamber, the deviation of "low frequency" signals from the inverse square law will be a function of distance from the sound source. The conventional tone-burst "echo" test is designed for use in large areas, and does not lend itself to application in smaller rooms. Anyone purchasing anechoic wedges for a sound analysis chamber should have several samples analyzed before wedges are installed. The samples evaluated should be fabricated from the same lot of material to be used in the wedges being purchased. Manufacturers of fiberglass anechoic wedges should not be able to use "across the board" in advertising, data obtained on a few samples on a given date. The cutoff frequency value for a given wedge design cannot be used to predict exactly the performance of a chamber using that design. The type of acoustical analyses to be carried out will dictate the performance requirements for the chamber (less critical for overall or A-weighted sound level measurements, more critical for a sound source containing a predominant pure tone).

by Richard A. Dykstra; Donald E. Baxa  
Kohler Co.; University of Wisconsin  
Rept. No. SAE-770764; 1977; 10p 20refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 748

### EMISSION CONTROL OF TWO-STROKE AUTOMOBILE ENGINE

Although it long has been considered that the 2-stroke engine cannot meet Japan's stringent 1978 exhaust emission standards for passenger cars, development work by Suzuki Motors has resulted in a catalytic emission control system for the water-cooled, 2-stroke, 3-cylinder engine powering the Suzuki Model E-SS12 minicar which enables the vehicle to meet the emission standards. The emission control system is based on a two-stage catalytic reaction, injection of secondary air in large quantity, and an improved catalyst suited for a 2-stroke engine cycle (specially surface-treated with much improved hydrocarbon(HC)-reduction capability, heat resistance, and durability). The operating temperature of the catalyst is lowered in this system, resulting in longer catalyst life. Following long-distance durability testing, continued operation of the system resulted in exhaust emissions of 0.16 g/km HC, 0.07 g/km CO

(carbon monoxide), and 0.10 g/km NOx (nitrogen oxides) on the 10-mode cycle compared to 0.25 g/km HC, 2.1 g/km CO, and 0.25 g/km NOx 1978 requirements for the same conditions. Favorable results were obtained on the 11-mode cycle as well.

by Hisao Uchiyama; Takahiro Chiku; Shigemasa Sayo  
Suzuki Motor Co., Ltd., Japan  
Rept. No. SAE-770766; 1977; 12p 1ref  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 749

### SAFETY AND COMFORT IN AN UNCONTROLLED ENVIRONMENT [OPERATOR'S STATION, LOGGING MACHINERY]

Safety, health, and comfort are the three basic items in considering optimum operating conditions for the forestry vehicle operator. Safety items relate to the prevention of accidents. Providing a healthy environment requires controlling the conditions that affect the physical well-being of the operator. Comfort quite often results from an extension of features designed to reduce safety and health problems; it provides an atmosphere that increases willingness and ability to work. The operator should be protected from falling objects, jillpokes, and rollovers. Noise levels should be kept to a minimum. Operating temperature and humidity should be controlled. Instruments and controls should provide maximum operating efficiency. Safe ingress and egress should be provided in all weather conditions. Specific criteria are discussed for providing optimum operating conditions in operator's stations of harvesting equipment used in the logging industry. Recommended solutions are applied to a mechanized logging system consisting of John Deere's JD743 Tree Harvester and John Deere grapple skidders. The Society of Automotive Engineers (SAE) has established the following procedures to test the structural integrity of the operator's station to insure safety for the operator: SAE J1040a (rollover protective structures); SAE J231 (falling objects); SAE J1084 (operator protective structures); SAE J185 (access systems). Exposure limits for various noise levels have been established by the Occupational Safety and Health Administration. Satisfying these limits and maintaining minimum vibration levels will provide a healthy environment for the operator. Various human engineering specialists have established parameters for optimum control layout, seat geometry, and temperature-humidity relationships for optimizing operator comfort. Interlocks must be provided that protect the operator from inadvertent actions that could place him in danger.

by V. C. Pierrot  
John Deere Dubuque Works, Forestry Products Div.  
Rept. No. SAE-770767; 1977; 14p 18refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977; also presented at 58th Annual  
Meeting of Woodlands Section, Canadian Pulp and Paper  
Assoc., Montreal, 27-30 Mar 1977.  
Availability: SAE

HS-024 750

### APPLYING THE "PRESSURE" TO A LIQUID SPRING OFF-HIGHWAY TRUCK SUSPENSION

A liquid compression-spring device has been developed as an alternative to mechanical, oil/pneumatic, and rubber types for

the suspension of a production off-highway truck. Incorporated in the liquid spring design are damping orifices which add shock absorption as an integral feature. The combination shock absorber and liquid spring is more commonly called a liquid ride strut. Euclid, Inc. has applied these struts in production, both on the front and rear axles, of the R-170 rear dump truck, which has a gross vehicle weight of 124,000 N (550,900 lb) with a payload of 76,400 N (340,000 lb). Nominal rear ride strut load reaction is 28,500 N (127,000 lb), including braking forces. Peak forces are 49,500 N (220,000 lb) in fluid compression, with an additional 45,000 N (200,000 lb) in an elastomeric compression stop. Despite these loads, the largest rod required to support them is only 114 mm (4.5 in) in diameter. The functional simplicity with which a liquid strut operates was one of the key factors in the choice of such a revolutionary approach to off-highway vehicle suspension. Other factors are inherent predictability, performance, durability, ease of maintenance, and simple construction. Since the liquid ride struts are unaffected by temperature, pressure, and rate of load input during operations, they are potentially more economical than other types of suspension.

by Manny H. Naft; Peter P. Seabase  
Euclid, Inc.  
Rept. No. SAE-770768; 1977; 11p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 751

### FERROGRAPHIC EVALUATION OF PUMP CONTAMINANT WEAR

Following a background discussion of results of previous research on contaminant wear of hydraulic pumps and pumping-type mechanisms, and a description of Ferrographic oil analysis for assessing wear caused by particulate contamination, results are presented of research activities using Ferrography to correlate wear debris generated during contaminant wear testing with degradation in performance of hydraulic pumps. The new technique of Ferrography offers a uniquely different approach to the assessment of pump contaminant wear; it provides a means of isolating wear debris from all other contaminants entrained in the system fluid and of evaluating the quantity and type of such debris. The Ferrograph utilizes a specially-developed magnet, which generates an ultrahigh gradient field near its poles to precipitate the wear particles from the vehicle fluid. One component of the Ferrographic system, a Direct Reading Ferrograph, provides values for debris density deposited at influent and effluent positions of a glass collection tube. A Slide Ferrograph uses an inclined, chemically-treated microscope slide (Ferrogram) as a substrate upon which particles are gathered; a Ferrogram Reader provides optical density information of the wear debris collected at various positions along the Ferrogram, and a Bichromatic Microscope is used to gain qualitative information about the particles. The results obtained thus far in the effort to apply Ferrographic techniques to the assessment of component contaminant wear have been very encouraging. A correlation has

been demonstrated between generated wear debris as evaluated Ferrographically and performance degradation.

by R. K. Tessmann; G. E. Maroney  
Oklahoma State Univ., Fluid Power Res. Center  
Rept. No. SAE-770769; 1977; 8p 10refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977. Supported by Office of Naval  
Res. and by U.S. Army, MERADCOM.  
Availability: SAE

HS-024 752

### NON-INTRUSIVE ACOUSTICAL DIAGNOSTICS FOR APPRAISING PUMP CONTAMINANT WEAR

A nonintrusive, acoustical diagnostic technique is discussed for assessing the wear and associated flow degradation of hydraulic pumps. The technique utilizes near-field, airborne noise measurements to determine the acoustical energy emitted by the pump at various pumping harmonics. Ratios of the pumping harmonic noise levels are transformed into a Noise Wear Index (NWI). Data are presented which show the correlation between NWI and gear-pump contaminant-induced wear as indicated by a degradation of pump flow performance. The use of the NWI for diagnosing system infirmities and improving system reliability is discussed. Since the NWI has a correlation significance of 99.5%, its use can provide non-intrusive quality control and reliability information, as well as detection of cavitation and wear. On the assembly line, the NWI can isolate those units which exhibit unusual spectra. During periodic maintenance checks, the index can be used to predict incipient failure, resulting in significant savings through a reduction of down time and maintenance costs. The NWI for a given pump configuration should be based on the "best" correlation determined by a regression on test results with a minimum of three samples.

by G. E. Maroney; R. K. Tessmann  
Oklahoma State Univ., Fluid Power Res. Center  
Rept. No. SAE-770770; 1977; 18p 20refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977. Supported by U.S. Army  
MERADCOM.  
Availability: SAE

HS-024 753

### PRACTICAL CONSIDERATIONS IN HYDRAULIC DRIVE SYSTEMS

In an initial section, 24 practical considerations in designing hydraulic and hydrostatic drive systems cover some of the more common mistakes made in circuit design. Suggestions are included on how to avoid the problems, with specific examples of available components that could be considered for some of the cases. A checklist, for each of the 24 design considerations, poses questions intended to help the designer or engineer recognize a potential problem and probe for solutions. The following 24 areas are considered: contamination, cavitation, shaft loading, pressure protection, low-speed and high-speed operation, inertia loading, free wheeling, vibration, safety, efficiency, temperature, torque, noise, duty cycle,

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physical size, weight, circuit compatibility, reversals, acceleration-deceleration, braking, serviceability, air, and reservoir.

by Rolland Nielson  
I. N. Fauver Co.  
Rept. No. SAE-770771; 1977; 15p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 754

### **PLANETARY DRIVES FOR HYDROSTATIC CRAWLER APPLICATIONS**

A successful approach to the design, testing, and application of planetary gear speed reducers for hydrostatic crawler propel systems is outlined. The design concepts embody application of high-speed, low-torque hydraulic motors to low-speed, high-torque output requirements. The importance of testing for rating confirmation is stressed. Propel performance can be predicted on a load/life basis for each specific application. The planetary drives feature compact design, simple installation, and full load output bearings, with highly reliable efficient performance assured by thorough dynamometer and field tests. Planetary gearing was selected because the compact modular concept is ideal for track drive space requirements; because each module is a balanced unit with self-contained force vectors; and because over three planet gear sets permit high torque capacities in compact unit envelopes at high efficiencies. Primary design features include simple planetary gearing, four planet output gearing, floating sun gears, O-ring seals (no gaskets), metal face seal on the output shaft, modified profile and crown shaved gearing, spur gear input drive, and one piece ring gear as the major structural component in the drive and both internal tooth ring gears.

by Robert M. Dick  
Sperry Rand Corp., Vickers Tulsa Div.  
Rept. No. SAE-770774; 1977; 7p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 755

### **THE DESIGN AND DEVELOPMENT OF A HEAVY-DUTY, OFF-HIGHWAY DIESEL ENGINE FAMILY. PT. 1: ENGINE CONCEPT AND DESIGN. PT. 2: COMPONENT TESTING AND ENGINE DEVELOPMENT**

A family of 3-, 4-, and 6-cylinder diesel engines with NA (naturally-aspirated) and TC (turbocharged) options was designed for use in a range of off-highway vehicles. Special requirements included robust construction, maximum reliability, a hydraulic power takeoff (PTO) up to a maximum equivalent to the power of the 4-cylinder NA engine, and low noise levels. In Pt. 1, the engine concept and design are described in detail, and the engine performance development, together with the use of models, rigs, and component tests, is discussed in detail in Pt. 2. The NA and first-stage TC development have been completed. Target power and fuel consumption were met easily within the prescribed smoke limit with a sufficient margin to allow for modification of the torque diagram to suit particular vehicle operating conditions. Turbocharged target performance also was exceeded with lower

torque backup of 11%. Higher backup of 15% to 20% could be achieved using an exhaust pressure wave conversion compressor with some improvement in fuel consumption and smoke. A steep ramp helical inlet port gave very good performance, with good gaseous emissions characteristics, and had sufficient further potential to be considered for higher turbocharged ratings. The 1000 hour tests gave a good indication of the probable engine durability and confirmed the suitability of shaved and crowned gears for the PTO drive. The tests also showed that further detailed attention should be given to rocker-bush life and the general relationships of crankshaft stiffness, crankcase rigidity, and bearing clearances. The use of a rigid cylinder block and bedplate construction with an enclosed front drive was shown to be effective in reducing noise levels. Variations in crankcase wall thickness had very little effect, confirming the design assumption that rigidity was the principal factor in engine noise reduction. Commonality of parts was maintained throughout the engine range, including unit heads, powertrain, valve train, timing train and auxiliary-drive components.

by H. W. Barnes-Moss; A. R. Crouch; P. J. S. Ritchie; K. C. Barnes-Moss  
Ricardo and Co. Engineers (1927) Ltd., England  
Rept. No. SAE-770775; 1977; 40p 4refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 756

### **A NEW METHOD OF VALVE CAM DESIGN--HYSDYNE CAM**

A new dynamic design method of determining cam profile is described which takes into account the hysteresis characteristics of the valve-train stiffness, thus named HYSDYNE cam. The design resulted from careful consideration of the equivalent valve mass and equivalent pushrod stiffness of the valve train. The logical analysis of the hysteresis characteristics of the actual valve train stiffness gave a rational procedure for the design of the cam profile, including the ramp profile. Reduced dynamic loading of the valve train, increased tolerance for valve linkage separations, and improved stability to valve response against valve clearance change were achieved. Experimental investigations have shown that the new method is effective over a wide range of operating conditions. Once the hysteresis characteristics of the valve train are assumed or measured in the valve gear under consideration, the cam profile can be computed rapidly with the least number of design parameters, to provide the actual valve motion in full agreement with the design.

by Hiroshi Kanesaka; Kishiro Akiba; Hiroshi Sakai  
Isuzu Motors Ltd., Japan; University of Tokyo, Tokyo, Japan  
Rept. No. SAE-770777; 1977; 10p 7refs  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 757

### **A PRACTICAL REVIEW OF HIGH VOLTAGE SAFETY DEVICES FOR MOBILE CRANES**

The observed operating characteristics are described of insulated boom cages, insulator links, and proximity warning devices offered by suppliers of auxiliary equipment for use on

mobile cranes, in an effort to prevent accidents involving electrical contact with power lines. These high-voltage safety devices are too limited at present to be recommended for general usage. The boom cage offers no protection for the load-lifting cable and only limited coverage of the boom tip. The dependable performance of this type of device is further limited by the hazard of dirt accumulation on the standoff insulators. The greatest risk in using insulator links is the very real hazard of electrically-conductive contaminants accumulating on the surface of the insulator blocks which will produce flashover at typical power-line voltages. The mechanical safety of a hook which relies upon resins and fiberglass structures to carry loads is also questionable. Other hazards are associated with insulator links because they will isolate only that portion of the load which is carried by the hook or grappling device. The electrical proximity warning device does not reliably detect power lines in typical power distribution systems consisting of multiple conductors. The sensitivity of the detector is confused by the variety of power-line configurations in modern systems coupled with the movement of trucks, materials, and the crane itself. The most effective solution to the problem of crane accidents involving electrical contact with power lines lies in the proper execution of the administrative and supervisory responsibility of a work project. Planning the position of a mobile crane so that no part of it or its load-suspending cable can possibly touch an electrical conductor is clearly the safest practice.

by George S. Allin; Jack T. Wilson; Richard E. Zibolski  
Harnischfeger Corp.  
Rept. No. SAE-770778; 1977; 16p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 758

### 3000 TON CAPACITY SHIP-MOUNTED REVOLVING CRANE FOR THE NORTH SEA OIL INDUSTRY

The latest of American Hoist and Derrick Co.'s Revolver cranes for offshore oil industry operations is the M-3000, a 300-ton capacity crane with a total boom length of 350 ft, which was developed to meet the requirements for offshore assembly of the drilling platform superstructure used by the North Sea oil industry. The size of the platform superstructure, plus the lift height requirements and the small percentage of time that sea and weather conditions are suitable for erection, dictate that the platform superstructure be fabricated on land in the largest economically-feasible packages or modules, brought to the platform site on barges, and lifted into place. Basically, the cranes and the platform structures must be designed for load conditions at least five times as severe as those to be found in the Gulf of Mexico (for which application the first Amhoist Revolver crane (Model R-40) was developed in 1953). A major departure from previous floating cranes is mounting the cranes on the decks of ships rather than barges. Since ships have better roll characteristics, they can withstand more severe weather. The operating conditions to be encountered in the North Sea demanded the crane to have a capability of hoisting the maximum 3000-ton load 9 ft/min. Often the conditions available for a maximum lift with a floating crane when the load is lifted from or onto another vessel or platform make it necessary to lift and set the load in minimum time. The four electrically-synchronized drums controlling the main-load block have a rated line pull of 130,000 lb each at 150 ft/min, an actual total output of over 2360 hp for the four

drums. Since 12 Jun 1976, one week after completion of load testing, the M-3000 Revolver crane has been working in the Brent Field approximately 100 mi from Norway above 60 degrees North latitude.

by Carl W. Ireland  
American Hoist and Derrick Co.  
Rept. No. SAE-770781; 1977; 12p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 759

### MODERN GEAR PUMPS ARE 95% EFFICIENT OR BETTER

Over the years the development of the gear pump for the mobile equipment market has improved greatly, both in efficiency and power output for a given size and cost. Rising speeds and pressures of diesel and gasoline engines have resulted in a spectacular increase in power output. The competitive nature of the market has prevented unit bulk or cost from rising in proportion to power output. High-pressure hydraulic circuits require a pump of high volumetric efficiency; without this capability, losses arising at the higher pressures will not only cause overheating at normal speeds due to high-pressure leakage, but will overheat at low speeds, when the leakage flow is a higher proportion of pump output and therefore represents a higher recirculation of heat. This can place unacceptable limitations on the minimum allowable speed of the pump at maximum pressure. The achievement of high volumetric efficiency as well as the ability to meet the requirements of structural strength, bearing life, etc., have opened the door to the development of high-pressure pumps. Two new ranges of high-pressure, high-efficiency gear pumps are the P3000 and the P4000. Full-flow relief valve bypass pressures of 3000 psi and 4000 psi, respectively, are achieved in these two ranges, with a maximum relief valve overshoot allowance of 4600 psi for the P4000, which also operates at no-load maximum speeds of up to 8000 rpm. These pumps are designed to achieve a production acceptance minimum value of volumetric efficiency equal to or better than (higher values) 96%, 97%, 98% for 1.2 cu in/rev, 2.3 cu in/rev, and 4.0 cu in/rev units, respectively, at 1500 rev/min, 3000 psi. These pumps have a uniform-section, through-bored body which contains the whole gear and bearing bush pack. The complete pumping assembly is aligned by delivery pressure which loads it onto the low-pressure side of the casing bores, which acts as a datum surface.

by E. J. Rock  
Dowty Corp.  
Rept. No. SAE-770782; 1977; 10p  
Presented at Off-Highway Vehicle Meeting and Exhibition,  
Milwaukee, 12-15 Sep 1977.  
Availability: SAE

HS-024 760

### DEVELOPMENT OF A PURE METHANOL FUEL CAR

A project to develop a methanol-fueled prototype car is described, the various stages of the development work are discussed, including fundamental research on a single-cylinder engine, basic work and adjustment on four-cylinder engines,

cold-start and driving tests, emission tests, and durability tests. (Supplementary laboratory work was done on fuels, lubricants, and materials.) Goals of the project included low energy consumption and emission rates, high power output, satisfactory cold start behavior, good driveability, and low production costs and maintenance requirements. The prototype developed is a small passenger car (VW Rabbit) with a 1.6 L, four-cylinder engine with a compression ratio of 12.5 and a single-barrel carburetor. Besides careful tuning, the utilization of different modifications in carburetor and ignition system, and the replacement of some plastic parts in the fuel-line system, no other major modifications were necessary. Several of these prototypes are now being durability tested under various conditions; up to 100,000 miles have been covered with no serious problems. Results of using the methanol-fueled vehicle show promising aspects of lower energy consumption, higher energy output, and more favorable emission figures. Although the volumetric fuel consumption is higher due to the lower energy content of methanol, the energy-based fuel economy will be considerably better. The unfavorable cold-start and warm-up behavior of pure methanol can be eliminated by the use of suitable additives.

by Holger Menrad; Wenpo Lee; Winfried Bernhardt  
Volkswagenwerk A.G., Germany  
BMFT-522-7291-TV-7525  
Rept. No. SAE-770790; 1977; 16p 18refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Sponsored by the Ministry of Res. and Technology (BMFT) of the Federal Republic of Germany.  
Availability: SAE

HS-024 761

#### **EFFECT OF COMPRESSION RATIO ON EXHAUST EMISSIONS AND PERFORMANCE OF A METHANOL-FUELED SINGLE-CYLINDER ENGINE**

Using methanol fuel, a single-cylinder, removable-dome-head engine was operated at compression ratios (CR's) from 8 to 18 to investigate tradeoffs between exhaust emissions and efficiency. Although trace knock occurred with MBT (minimum advance for best torque) spark timing at CR equal to 18, the engine did not knock at CR's of 16 or less during the 1200 rpm, half-throttle test condition. At MBT spark timing, efficiency and power increased about 16% as CR increased from 8 to 18. Retarding spark timing 5 degrees from MBT decreased efficiency and power about 2%. NO<sub>x</sub> (nitrogen oxides) emissions never decreased as CR increased while MBT spark timing was maintained. Instead, NO<sub>x</sub> emissions at CR equal to 18 were, depending on the equivalence ratio (which was varied from 0.7 to 1.1), 15% to 200% greater than those at a CR of 8. This conflicts with results of some previous studies, possibly because MBT spark timing was not maintained in those studies. When NO<sub>x</sub> emissions were reduced at the higher CR's by retarding spark timing, efficiency was still greater than that at CR equal to 8 with MBT spark timing. At an equivalence ratio of 0.9, for example, with CR equal to 18 and spark timing retarded 10 degrees from MBT (instead of CR equal to 8 and MBT spark timing), NO<sub>x</sub> emissions decreased 40% while efficiency increased 10%. Unburned fuel (UBF) emissions increased 60% to 150% as CR increased from 8 to 18, although retarding the spark timing only marginally reduced UBF emissions. Tradeoffs among NO<sub>x</sub> emissions, UBF emissions, and efficiency with methanol fueling were similar to those previously reported for gasoline-fueled engines. Vehicle tests are necessary to determine the CR, equivalence ratio, and spark timing which provide maximum efficiency while satisfying ex-

haust emission constraints. Apparently, CR will be limited by constraints of UBF emissions or knock, but not NO<sub>x</sub> emissions.

by Norman D. Brinkman  
General Motors Res. Labs.  
Rept. No. SAE-770791; 1977; 15p 30refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Availability: SAE

HS-024 762

#### **METHANOL AS A FUEL: A REVIEW WITH BIBLIOGRAPHY**

A survey of recent studies and research on methanol as a fuel is presented within the historical context. Fuel-related properties are reviewed and compared with isooctane. Combustion emissions and their variation with temperature and fuel preparation are similarly compared. Uses of methanol as a combustion fuel and recent tests in boilers, turbines, conventional and stratified-charge Otto engines, and diesel engines are discussed with emphasis on comparative efficiencies. Current developments on the uses of methanol directly and indirectly in fuel cells and as a feedstock for single-cell protein are examined. The relevant biological, physical, and chemical hazards of using methanol as a fuel are discussed together with safety precautions and treatment. A comprehensive bibliography is provided. Based on studies during the last decade, methanol is emerging as a more efficient fuel overall than other synthetic fuels, capable of meeting the most stringent Federal standards with little reduction in conversion efficiency in vehicles. Tests show that methanol is well suited for combustion in boilers and turbines in utility-electricity generation; this may be the first large-scale application of methanol as a fuel. Recent technological advances in microcomputers, stratified-charge combustion, heat pipes, fuel injection and atomization offer significant potentials in converting to an efficient, versatile methanol or multifuel economy, with considerably higher fuel efficiency and lower emissions. Blends of methanol in gasoline also appear to be a possible means of introducing methanol into the market. Corrosion, water-free distribution, economics, and handling precautions in light of methanol's toxicity are the main problem areas. Next to hydrogen, methanol appears to be one of the strongest contenders as a fuel for electrochemical oxidation in fuel cells. Single-cell protein now being manufactured using methanol as a feedstock could provide a major alternative source of protein in the near future.

by David L. Hagen  
University of Minnesota, Dept. of Mechanical Engineering  
Rept. No. SAE-770792; 1977; 36p 353refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Adapted from two sections of a more comprehensive review of methanol written for master's thesis and available from NTIS (NP-21727).  
Availability: SAE

HS-024 763

#### **ALTERNATIVE DIESEL ENGINE FUELS: AN EXPERIMENTAL INVESTIGATION OF METHANOL, ETHANOL, METHANE AND AMMONIA IN A D.I.**

# **[DIRECT INJECTION] DIESEL ENGINE WITH PILOT INJECTION**

An experimental investigation of methanol, ethanol, methane, and ammonia as primary fuels for the high-speed direct-injection diesel engine with pilot-injected diesel fuel as the source of ignition, showed that all of the alternative fuels were applicable. Methane was found to be the most suitable fuel and ammonia the least suitable. With methane, it was possible to run the engine at total air-fuel ratios below stoichiometric, thus increasing the maximum output of the engine considerably. The ignition delay of the pilot-injected diesel fuel was affected only slightly, except at very rich mixtures. Ammonia was found unsuitable mainly because of a strong emission of unburnt ammonia, but also because it gave the strongest increase in the ignition delay of the pilot-injected diesel fuel and the smallest increase in maximum power output and efficiency. The latter effects are thought to be due mainly to a very slow combustion of the ammonia. Methanol and ethanol showed similar behavior, ethanol being the more suitable fuel. Methanol was very sensitive to operating conditions. Small changes in the amount of pilot fuel or the amount of methanol could cause large changes in the power output. The use of any of the four alternative fuels reduced the emission of smoke from the engine and increased the emission of unburnt fuel (hydrocarbons and/or ammonia). The emission of carbon monoxide was largely unchanged for all of the fuels. The emission of nitrogen oxides increased moderately using methanol and ammonia, while methane gave nearly a five-fold increase near the stoichiometric mixture and methanol gave a somewhat lower emission.

by Klaus Bro; Peter Sunn Pedersen  
Technical Univ. of Denmark  
Rept. No. SAE-770794; 1977; 16p 18refs  
Presented at Passenger Car Meeting, Detroit, 26-30 Sep 1977.  
Research sponsored by Statens teknisk-videnskabelige Forskningsrad (Danish Council for Scientific and Technical Res.).  
Availability: SAE

HS-803 530

# **CALIBRATION OF THREE YEAR OLD CHILD DUMMIES. FINAL REPORT**

A test program was undertaken to develop appropriate calibration procedures to measure the dynamic response of a three-year-old dummy by acceleration tests. The calibration procedure consisted of head and chest impact tests, head-neck pendulum tests, and lumbar spine flexion tests. Procedures, equipment, configurations, and results of the test program are presented. It is concluded that acceleration can be used to measure the dynamic response of a three-year-old dummy, that the head impact tests, head-neck pendulum tests, and lumbar spine flexion tests gave repeatable data, and that the chest impact data are inconsistent. Test setup and/or test probe design appear to be extremely critical. The data are appended.

by Anthony R. Bayer, Jr.; Robert W. Lum  
National Hwy. Traffic Safety Administration, Engineering Test Facility, P.O. Box 37, East Liberty, Ohio 43319  
Rept. No. NHTSA-TR-OCW-278-1; 1978; 380p  
Rept. for Feb-May 1978.  
Availability: NTIS

HS-803 537

# **CATEGORIZATION AND CHARACTERIZATION OF AMERICAN DRIVING CONDITIONS (PHASE 1). FINAL REPORT**

A study was undertaken to develop a multidimensional matrix as an analysis framework to classify travel of personal motor vehicles according to fuel consumption, to identify and assess available information on travel and fuel consumption, and to describe how to use specific information for quantifying the matrix. A review of the fuel economy literature revealed a large number of factors which influence fuel consumption, only some of which were related to driving conditions. The factors categorizing driving conditions were selected according to their independence, their relationship to fuel consumption, and their interest for studying fuel economy policies. The selected factors include trip purpose, trip length, time, geographic area, highway class, and vehicle class and model year. Fuel consumption rates can be estimated from vehicle and trip characteristics including trip length, ambient temperature, and average trip speed. These last two factors are not dimensions of the matrix but are generally determined by time, geographic area, highway class, and trip length. Currently available sources of vehicle travel information are not sufficiently detailed to disaggregate VMT (vehicle miles of travel) according to the selected factors, although sufficient basic data are available to estimate VMT under the selected driving conditions. The most detailed information was collected by the 1977 Nationwide Personal Transportation Study, conducted by the Bureau of the Census for the Federal Hwy. Administration. Other information is collected regularly by traffic counting programs, and by motor vehicle inspection programs in certain states. An approach was outlined to estimate VMT from these sources, disaggregated according to the factors characterizing driving conditions. Potential errors of the estimates were estimated. Promising statistical methods for quantifying the matrix were identified, although some aspects of estimating error cannot be addressed without an analysis of the actual data. A plan for implementing this methodology is presented. Illustrative examples of a scaled-down matrix and its use are appended.

by Hans C. Jokschi; Joseph C. Reidy, Jr.  
Center for the Environment and Man, Inc., 275 Windsor St., Hartford, Conn. 06120  
DOT-TSC-1419  
Rept. No. DOT-TSC-NHTSA-78-41; CEM-4230-617; 1978; 199p 298refs  
Rept. for Oct 1977-Jul 1978.  
Availability: NTIS

HS-803 542

# **MULTINATIONAL ACTIVITIES OF MAJOR U.S. AUTOMOTIVE PRODUCERS. FINAL REPORT. VOLS. 1, 2, 3, 4, AND 5**

The multinational activities of General Motors (GM), Ford, Chrysler and American Motors are documented in this five-volume report. Vol. 1, Summary, briefly describes and assesses these activities, which have relevance for domestic transportation and energy policy. Evaluation of these activities suggests that the U.S. automobile industry will choose modified conventional technology and continued foreign expansion over the development of a new, fundamentally different, automotive industry, a choice encouraged by the U.S. Government's current policies. The net result is that U.S. producers will remain net exporters of U.S. technology, bring-



ing about an ever-diminishing competitive position for the domestic operations of the U.S. multinationals and an adverse effect on the U.S. economy. Vol. 2, Data on Foreign Facilities and Operations, provides (Part 1) data on the foreign operations of the above-named U.S. auto producers, and (Part 2) aggregate data for GM, Ford, and Chrysler. Individual data include estimates of research, development, and engineering (R,D and E) activities abroad. Data from both parts are cross-classified for a number of variables, such as location, purpose, type, and total expenditure. Vol. 3, Research, Development and Engineering Abroad, presents a number of findings about the current level (1976), growth, and composition of R,D and E abroad, as well as the location, primary purpose, evolution and the critical factors causing this foreign activity. There is indication of a shift in the last decade to R,D and E responsibility from national to regional markets, with a future shift to develop new products and processes expressly for near-simultaneous production in all major world markets. Ford's Fiesta may be an early forerunner of this trend. Vol. 4, A Preliminary Evaluation of Technology Innovation and Transfer, evaluates internal transfer of technology within each U.S. multinational producer. These transfers tend to be informal, unplanned, fuel-economy-related, and for purposes of complementing production operations. Possible results of these transfers may include increased concentration of automotive resources through merger and consolidation, increased multinationality of operations, increased product standardization, higher productivity of product/process innovation, greater potential technology transfers, and increased economic nationalism and protection. Vol. 5, Diffusion of Production and Sales Operations Abroad, provides various findings about the motivation for investing in production and sales operations abroad, the timing and location, concentration and size of these investments, and the market destination of sales. The findings indicate a diminishing U.S. role in the world automotive industry, with continual pressure on the U.S. trade position in motor vehicles, continued deterioration of the U.S. share of world auto production, and continual expansion abroad by the U.S. automotive multinationals in new markets in Latin America, Africa, the Far East, and the Middle East.

by Robert C. Ronstadt; William Casey; J. P. Jeannet; John Marthinsen; Robert Whorf  
Robert C. Ronstadt Associates, Inc., 46 Glen St., Dover, Mass. 02030  
DOT-TSC-1387  
Rept. No. DOT-TSC-NHTSA-78-21-(Vol-1,2,3,4,5); 1978; 5v refs  
Rept. for Jul 1977-Apr 1978. Bound in 5 vols.  
Availability: NTIS

HS-803 546

# **PROCEDURES FOR MONITORING THE IMPORTATION OF MOTOR VEHICLES AND MOTOR VEHICLE EQUIPMENT, AS PROVIDED IN TITLE 19--CODE OF FEDERAL REGULATIONS 12.80**

Customs regulation 19 CFR 12.80 was issued jointly by the Secretary of the Treasury and the Secretary of Transportation to provide procedural guidance and regulation for the importation of motor vehicles and items of motor vehicle equipment subject to the requirements of the National Traffic and Motor Vehicle Safety Act of 1966. Motor vehicles/equipment manufactured on or after 1 Jan 1968, offered for sale, or introduced in interstate commerce, or imported into the U.S. are subject to Federal Motor Vehicle Safety Standards (FMVSS) prescribed by the Act, as amended, and set forth in 49 CFR

Part 571. Information on Federal requirements for motor vehicles and equipment imported into the U.S. are set forth in the following sections: regulations for motor vehicle importation; text and location requirements for certification labels for vehicles; text and location for certification labels for items of motor vehicle equipment; certification rules and regulations applicable to vehicles manufactured between 1 Jan 1969 and 31 Aug 1969; certification rules and regulations applicable to vehicles manufactured between 1 Sep 1969 and 31 Dec 1971; certification rules and regulations applicable to vehicles manufactured on or after 1 Jan 1972; certification rules and regulations applicable to vehicles manufactured in two or more stages on or after 1 Jan 1972; and excerpts from Part 571 (FMVSS).

National Hwy. Traffic Safety Administration, Washington, D.C. 20590  
1978; 39p refs  
Availability: Corporate author

HS-803 611

## **SAFETY HELMET PERFORMANCE INVESTIGATION. VOL. 1. FINAL REPORT**

A study was undertaken to determine some of the characteristics of two sets of headforms (designated DOT and SHCA, respectively) which had been manufactured for use in testing motorcycle safety helmets in accordance with Federal Motor Vehicle Safety Standard (FMVSS) 218. Each set consists of four sizes (A, B, C, and D). In addition, a better geometric definition of the Z90 C headform which is used currently in FMVSS testing was sought. The DOT A, B, C, and D headforms failed to meet the constraints of FMVSS 218 with regard to external dimensions, total weight when the center of gravity was properly located, and resonances occurring below the 3000 Hz limit. The greatest discrepancy in exterior dimensions appears for horizontal sections where the radius of curvature of the headform is very large. Resonances associated with the DOT and SHCA headforms are primarily noncoupled resonances. Lower frequency resonances occur where the excitation point is located on the right or left side; this is because the top of each headform is thicker than the sides. Impact tests performed using the DOT C headform with drop heights adjusted to 94% of the normal drop heights to compensate for the headform overweight condition gave conservative results for the same helmet model which had been previously tested using the Z90 C headform. The spread in Modular Elastomer Programmer (MEP) drop peak acceleration values for a fixed drop height as a function of impact location substantiates the sensitivity of the apparatus to MEP impacts at headform locations with large radii of curvature. The characteristics of the MEP acceleration time histories are a strong function of impact location and drop height, but a weak function of multiple resonances of the headforms which occurred below 3000 Hz. If the weight constraint of FMVSS 218 is relaxed for the A, B, and D headforms, the results of impact tests performed for drop heights adjusted on the basis of energy conservation are conservative. Impact tests performed with the DOT A, B, and D headforms for the normal drop heights of 54.5 in and 72 in produced about a 10% failure rate, with all failures resulting from exceeding the 2 msec time interval limit at 200 G's. In general, the results indicate that DOT and SHCA headforms could not be made to meet all FMVSS 218 constraints; an investigation should be made to determine the feasibility of designing headforms to meet the current standard



or to decide if some portions of the standard should be changed.

by R. L. Bessey  
Southwest Res. Inst., 6220 Culebra Rd., San Antonio, Tex.  
78284  
DOT-HS-6-01395  
1978: 53p 5refs  
Rept. for Aug 1976-May 1978. Vol. 2, Appendices, is HS-803 619.  
Availability: NTIS

HS-803 619

### **SAFETY HELMET PERFORMANCE INVESTIGATION. VOL. 2: APPENDICES A THROUGH L. FINAL REPORT**

Data obtained from a study to investigate the feasibility of performing motorcycle safety helmet compliance tests to Federal Motor Vehicle Safety Standard (FMVSS) 218 with three sizes of test headforms (A, B, and D) in addition to the size C headform currently in use, are presented in tabular and graphical form. Appendices cover data on DOT A, B, D compared to Z90 C; resonant search of DOT C; Modular Elastomer Programmer (MEP) impact data for DOT C headform; acceleration-time histories for MEP impacts using the DOT C headform; a comparison of impact data for FMVSS 218 tests run with the DOT C headform and the Z90 headform; acceleration-time histories for impact tests using DOT C headform; results of resonant frequency search for DOT A, B, and D headforms; MEP impact data for DOT A, B and D headforms; acceleration-time histories for MEP impacts using the DOT A, B and D headforms; impact test data obtained using DOT A, B and D size headforms; vertical and horizontal sections of the Z90 C headform used in FMVSS 218 compliance testing; and results of resonant frequency search for SHCA A, B, C and D headforms.

by R. L. Bessey  
Southwest Res. Inst., 6220 Culebra Rd., San Antonio, Tex.  
78284  
DOT-HS-6-01395  
1978: 637p  
Rept. for Aug 1976-May 1978. Vol. 1 is HS-803 611.  
Availability: NTIS

HS-803 670

### **DEVELOPMENT OF A SOLID PROPELLANT INFLATION TECHNIQUE FOR THE SUBCOMPACT CAR PASSENGER RESTRAINT SYSTEM. PHASE 1. FINAL REPORT**

A detailed explanation is given of the objectives of a program to develop a solid propellant inflation technique for a subcompact car passenger restraint system, the criteria for meeting those objectives, the methodology for selecting the restraint system components, the results of the sled tests conducted, and the integration of the system into the Calspan RSV (research safety vehicle) for crash testing in Phase 2 of the program. In Phase 1, a thorough review was made of recent restraint system development for the right front passenger. This system utilizes a solid pyrotechnic inflator as the gas generant source. The necessary components were procured, such as inflators (Thiokol), the Simca (Calspan RSV base vehicle) knee bolsters (Wilshire Foam Co.), seats (Calspan Corp.),

and air bags (Allied Chemical Co. for the materials and Remmers-Sailmaker for the bag fabrication). A series of 77 sled tests was conducted in which the system was gradually developed and ultimately finalized for Phase 2 evaluation, and the Phase 1 system was integrated into the Calspan RSV. The performance objective of the air cushion restraint system (inflator, air bag, knee restraint) is to provide acceptable 45 mph performance for a broad range of occupant sizes (from the 6-yr-old child to the 50th percentile adult male) in natural sitting positions. A preliminary conclusion drawn from this first phase is that the system will probably meet the objectives and criteria specified.

by Michael Fitzpatrick  
Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017  
DOT-HS-6-01384  
1978: 133p  
Rept. for Jul 1976-Oct 1978.  
Availability: NTIS

HS-803 671

### **TEST AND EVALUATION OF HEAD RESTRAINTS, SEAT BACKS, AND ANCHORAGES IN VEHICLES SUBJECTED TO REAR IMPACT COLLISION. FINAL REPORT**

A series of car-to-car crash tests were conducted primarily to test and evaluate fuel system integrity in rear impact collisions; these tests additionally were instrumented to allow for the collection of baseline data in other areas. Baseline data on head restraint, seat back, and anchorage performance are presented, which were collected during 12 of these tests. Velocities of the striking vehicles (1971 Chevrolet Impalas) ranged from 29.01 mph up to 40.74 mph. The struck vehicles were 1971, 1972, 1974, and 1976 model year Ford Pintos (2-door, 3-door, wagon); 1971 and 1972 model year Chevrolet Vegas (3-door); and a 1971 model year Chevrolet Impala (4-door). The struck vehicle in these tests was equipped with an instrumented 50th percentile male dummy located in the driver's seat, string potentiometers, and high-speed, on-board motion cameras to document driver's seat and seat back motion, and vehicle frame accelerometers to record the occupant compartment response. A comparison between component failure/yield and causative forces is presented. With the exception of one test (Chevrolet Impala as struck vehicle), all vehicle seat backs were permanently deformed beyond the nominal pretest condition. Seat anchorage points in all tests showed no signs of deformation or failure during the test series. In general, the seat back deformations appeared to have occurred as a result of seat back brace rotation and asymmetrically-applied bending due to dummy setback forces.

by R. Pirtle  
Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027  
DOT-HS-8-01886, Mod. 1  
Rept. No. DS-3005-78-84; 1978: 180p  
Rept. for Jan-Mar 1978.  
Availability: NTIS

HS-803 687

### **SAFETY RELATED RECALL CAMPAIGNS FOR MOTOR VEHICLES AND MOTOR VEHICLE EQUIPMENT, INCLUDING TIRES, REPORTED TO THE NATIONAL HIGHWAY TRAFFIC SAFETY**

**ADMINISTRATION BY DOMESTIC AND FOREIGN  
VEHICLE MANUFACTURERS, JULY 1, 1978 TO  
SEPTEMBER 30, 1978**

This tabulation of safety defect recall campaign information includes the NHTSA identification number, date of company notification, make, model, model year, number of pages on file, number of vehicles recalled, and brief description of defect and manufacturer's corrective action. Automobiles, buses, trucks, truck tractors, trailers, motorcycles, motorhomes, travel trailers, mopeds, power cylinder mounting brackets, carburetors, anti-lock system valves, ball joints, and tires are included. The status of domestic and foreign campaigns completed as of 30 Jun 1978 is also given.

National Hwy. Traffic Safety Administration, Washington,  
D.C. 20590  
1978; 38p  
Availability: GPO, stock no. 050-003-00334-4

HS-803 765

**RESEARCH SAFETY VEHICLE, PHASE 3. STATUS  
REPORT NO. 11. PERIOD: 1 SEPTEMBER TO 31  
OCTOBER 1978**

During the reporting period, attention has been focused on the Phase 4 vehicle fabrication and further development of restraint systems. Since the HYGE sled is incapable of duplicating the 70 G deceleration pulse measured in Test No. 10, a combined experimental and simulation approach has been taken to further develop the restraint systems to achieve satisfactory performance. A sled pin was developed to simulate as nearly as possible the results of the 44 mph test of the Phase 4 prototype vehicle. A second sled pin was devised to simulate the 40 mph deceleration pulse. Using those pins with a minimum skeleton sled buck, a single occupant, and the boiler plate dash, and subsequently the actual vehicle instrument panel and knee blocker, sled tests revealed inadequacies in current design, largely associated with providing adequate stabilization for support for the knee blocker itself. To assess modifications to the knee blocker support, a series of static tests has been undertaken to indicate force deflection characteristics resisting the thrust of a pair of knees into the knee blocker assembly. Although progressing well, the fabrication effort is taking longer than anticipated because of the many problems encountered in assembling all the different parts for the first time. Specific problems occurred in the assembly of the different components that make up the doors, the installation of the bumpers on the front and rear of the car, and the installation of the Cibie automatic leveling devices for the lights. The decision to utilize the Chrysler L-car wiring harness entails repositioning of some of the accessories in addition to specific placement (for the first time) of the components of the diagnostic system utilized in conjunction with the air bag and inflatabelt restraint systems. However, the first Phase 4 vehicle fabricated, a pedestrian crash buck, was shipped, and a second is awaiting shipment. Meetings were attended with representatives of the agencies receiving Phase 4 vehicles in order to better acquaint them with the RSV (research safety vehicle) design. The first full driveable vehicle, Car No. 3, was being assembled at the end of the reporting period.

Calspan Corp., Calspan Advanced Technology Center, P.O.  
Box 400, Buffalo, N.Y. 14225  
DOT-HS-7-01551  
Rept. No. CAL-ZN-6069-V-25; PR-11; 1978; 89p 3refs  
Availability: Corporate author

HS-803 774

**SAFETY BELT USAGE: SURVEY OF CARS IN THE  
TRAFFIC POPULATION (NOVEMBER 1977-JUNE  
1978) [U.S.]**

As part of ongoing measurements, a sample of 19 metropolitan areas in the U.S. was selected to determine safety belt use rates from Nov 1977 to June 1978, according to type of belt system, sex of driver, age of driver, model year of car, region of country, type of road, weather conditions, and month of year. Measurement was made by trained observers at selected intersections and freeway exits. For this period, safety belt usage for 1964-1978 model year cars was 14.1% (9.2% for lap and shoulder belt, 4.9% for lap belt only). This usage rate has not varied much from month to month in the recent past. Usage was highest (17.1%) for 1974 (interlock) model cars and declined to a 13%-14% level for 1975-1978 cars, which have only the 8-second buzzer and warning light. In general, usage was highest for subcompact cars (18.8%), next highest for compact cars (14.9%), and lowest for intermediate and full-size cars (11.2%). Among late model cars (1976-1978), the VW Rabbit with passive restraint system scored an outstanding lead on usage (78.7%). The VW Rabbit with active restraint system scored 33.8%. Other foreign cars observed generally scored higher than the four leading American makes. Usage rates were higher for women than men (16.4% vs 12.6%), and higher in the West (18.5%) than in other regions. The usage rates according to road type were turnpikes (17%), freeway exits (15%), primary roads (13%), and rural roads (7%). Turnpikes were covered primarily to measure daytime vs. nighttime usage rates (17% vs 18%, respectively).

Opinion Res. Corp., N. Harrison St., Princeton, N.J. 08540  
DOT-HS-7-01736  
1978; 48p  
Availability: Reference copy only

HS-803 775

**AN EXPERIMENTAL EVALUATION OF THE  
EFFECTIVENESS OF SHORT TERM EDUCATION  
AND REHABILITATION PROGRAMS FOR  
CONVICTED DRINKING DRIVERS**

Some results are reported of a Short Term Rehabilitation (STR) study, conducted at 11 different Alcohol Safety Action Project (ASAP) sites across the U.S. to measure the effectiveness of education and rehabilitation programs for DWI (driving while intoxicated) offenders. Follow-up studies were made of treatment and no-treatment control groups of persons diagnosed as moderate problem drinkers; these groups were compared according to four categories of treatment: direct traffic safety measures, direct drinking measures, life status measures, and personality measures. Three distinctly different analytical procedures were employed to assess treatment effectiveness: survival rate analysis for rearrest data, analysis of covariance for total arrest and accident data, and profile analysis for both direct drinking and life-status measures. The presence of only two statistically significant differences among 23 dependent variables tested for the treatment vs. control groups provides little evidence for treatment effect in the total treatment design. Furthermore, the fact that the two significant findings are in conflict (one positive and one negative effect), indicates the ineffectiveness of the education/rehabilitation program within the framework of this comparison. The results of the present study should not be taken

to suggest that education and treatment programs can have no impact. They merely provide no evidence of success for the programs examined. In addition, the results should not be taken to suggest that such programs should be discontinued; on the contrary, discontinuation would eliminate the potential for such programs to have an effect. Finally, laws which require the attendance of convicted DWI's at education and/or rehabilitation programs in lieu of losing their license cannot be supported objectively on the basis that they result in a safer driving environment.

by James L. Nichols; Vernon S. Ellingstad; David L. Struckman-Johnson

National Hwy. Traffic Safety Administration, Office of Driver and Pedestrian Programs, Washington, D.C. 20590; University of South Dakota, Human Factors Lab., Vermillion, S. Dak. 1978; 44p 18refs

Presented at National Council on Alcoholism Forum, St. Louis, 2 May 1978.

Availability: Reference copy only

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BICYCLE COMPLIANCE TEST MANUAL. REGULATORY DOCUMENTS: FRN JULY 16, 1974, FRN NOVEMBER 13, 1975, FRN JANUARY 28, 1976

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1: ENGINE CONCEPT AND DESIGN. PT. 2: COM-  
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HS-024 716

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FORCES IMPOSED ON THE HIP-JOINT IN CAR COLLISIONS

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PLANETARY DRIVES FOR HYDROSTATIC CRAWLER APPLICATIONS

HS-024 754

**State of Washington Dept. of Licensing, Driver Improvement Div., Highways-Licenses Bldg., Olympia, Wash. 98504**

ALCOHOL TRAFFIC SAFETY PROGRAM

HS-024 700

**Suzuki Motor Co., Ltd., Japan**

EMISSION CONTROL OF TWO-STROKE AUTOMOBILE ENGINE

HS-024 748

**Technical Univ. of Denmark**

ALTERNATIVE DIESEL ENGINE FUELS: AN EXPERIMENTAL INVESTIGATION OF METHANOL, ETHANOL, METHANE AND AMMONIA IN A D.I. [DIRECT INJECTION] DIESEL ENGINE WITH PILOT INJECTION

HS-024 763

**Texas Tech Univ., Lubbock, Tex.**

EMERGENCY MEDICAL CARE

HS-024 699

**Transport and Road Res. Lab., Accident Investigation Div., Crowthorne, Berks., England**

ACCIDENTS ON URBAN ARTERIAL ROADS

HS-024 697

**Transport and Road Res. Lab., Assessment Div., Crowthorne, Berks., England**

A SURVEY OF SOUTHBOUND MOTORWAY [HIGHWAY] TRAVEL ON THE M6, M5 AND M1 IN 1975

HS-024 696

**Transport and Road Res. Lab., Hwy. Traffic Div., Crowthorne, Berks., England**

ROUTE CHOICE BY DRIVERS

HS-024 695

**Transportation Res. Board, Subcommittee on Definitions, 2101 Constitution Ave., N.W., Washington, D.C. 20418**

GLOSSARY OF URBAN PUBLIC TRANSPORTATION TERMS

HS-024 693

**Transportation Res. Board, 2101 Constitution Ave., N.W., Washington, D.C. 20418**

APPLICATIONS OF INTERACTIVE GRAPHICS [TRANSPORTATION STUDIES]

HS-024 660

**Transportation Systems Center, Office of Public Information, Cambridge, Mass.**

MPG'S: FINDING WHAT YOUR CAR WILL AND WON'T DO. SYSTEMS CENTER HELPS DOT PUSH ENERGY CONSERVATION [DEPARTMENT OF TRANSPORTATION, TRANSPORTATION SYSTEMS CENTER]

HS-024 742

**Transportation Systems Center, Transportation Information Div., Kendall Square, Cambridge, Mass. 02142**

NATIONAL TRANSPORTATION STATISTICS. ANNUAL REPORT

HS-024 611

**University of California, Inst. of Transportation Studies and School of Social Sciences, Irvine, Calif.**

A DISAGGREGATE MODEL OF AUTO-TYPE CHOICE

HS-024 626

**University of California, Lawrence Livermore Lab., P.O. Box 808, Livermore, Calif. 94550**

DETERMINATION OF THE EFFECTIVENESS AND FEASIBILITY OF REGENERATIVE BRAKING SYSTEMS ON ELECTRIC AND OTHER AUTOMOBILES. FINAL REPORT. VOL. 2: DESIGN STUDY AND ANALYSIS

HS-024 645

**University of Connecticut, Civil Engineering Dept., Storrs, Conn. 06268**

EXPERIMENTAL EVALUATION OF A PORTABLE ENERGY ABSORBING SYSTEM FOR HIGHWAY SERVICE VEHICLES. PHASE 1. FINAL REPORT

HS-024 736

**University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742**

STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. INTERIM REPORT, PHASE 3. REPORT 3-1, VEHICULAR PLATOON PARAMETERS; A METHODOLOGY FOR TRAFFIC CONTROL

HS-024 574

STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. INTERIM REPORT, PHASE 3. REPORT 3-2, A METHODOLOGY TO MEASURE THE INFLUENCE OF TRUCKS ON THE FLOW OF TRAFFIC

HS-024 575

STUDY OF TRAFFIC FLOW ON A RESTRICTED FACILITY. FINAL PROJECT REPORT

HS-024 606

**University of Melbourne, Human Factors Res. Group,  
Melbourne, Vic., Australia**  
SURVEY OF VEHICLE HANDLING

HS-024 633

**University of Michigan, Hwy. Safety Res. Inst.**  
THE RELATIONSHIP BETWEEN OCCUPANT SAFETY  
AND THE PROPORTION OF SMALL CARS ON THE  
ROAD

HS-024 704

**University of Michigan, Hwy. Safety Res. Inst., Ann  
Arbor, Mich. 48109**  
DESIGN FOR A CHEVETTE SEAT BELT  
USAGE/DEFEAT SURVEY. FINAL REPORT

HS-024 577

**University of Minnesota, Dept. of Mechanical  
Engineering**  
METHANOL AS A FUEL: A REVIEW WITH BIBLIOG-  
RAPHY

HS-024 762

**University of Nebraska-Lincoln, Dept. of Agricultural  
Economics, Lincoln, Nebr.**  
GRAIN ALCOHOL IN MOTOR FUELS: AN EVALUA-  
TION

HS-024 675

**University of North Carolina, Hwy. Safety Res. Center,  
Chapel Hill, N.C.**  
AIR CUSHION RESTRAINT SYSTEM (ACRS): A SUR-  
VEY OF OWNERS' OPINIONS

HS-024 671

**University of South Dakota, Human Factors Lab.,  
Vermillion, S. Dak.**  
AN EXPERIMENTAL EVALUATION OF THE EFFEC-  
TIVENESS OF SHORT TERM EDUCATION AND  
REHABILITATION PROGRAMS FOR CONVICTED  
DRINKING DRIVERS

HS-803 775

**University of Texas at Austin, Center for Advanced  
Transportation Studies, Austin, Tex. 78712**  
PERSONALITY FACTORS IN ACCIDENT CAUSATION

HS-024 659

**University of Texas at Austin, Council for Advanced  
Transportation Studies, Austin, Tex. 78712**  
DRUGS AND THEIR EFFECT ON DRIVING PER-  
FORMANCE

HS-024 674

**University of Tokyo, Tokyo, Japan**  
A NEW METHOD OF VALVE CAM DESIGN--  
HYSDYNE CAM

HS-024 756

**University of Wisconsin**  
THE EVALUATION OF A SEMI-ANECHOIC  
CHAMBER USED FOR SMALL-ENGINE SOUND  
ANALYSES

HS-024 747

**Urban Behavioral Res. Associates, Inc., 3518 Laclede  
Blvd., St. Louis, Mo. 63103**  
DETERMINATION OF MOTOR VEHICLE EYE  
HEIGHT FOR HIGHWAY DESIGN. FINAL REPORT

HS-024 707

**Volkswagenwerk A.G., Germany**  
DEVELOPMENT OF A PURE METHANOL FUEL CAR  
HS-024 760

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University of Texas at Austin, Center for Advanced Transportation Studies, Austin, Tex. 78712

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University of Texas at Austin, Council for Advanced Transportation Studies, Austin, Tex. 78712

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### AW-76-116-46

University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742

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University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742

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University of Maryland, Dept. of Civil Engineering, College Park, Md. 20742

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### BMFT-522-7291-TV-7525

Volkswagenwerk A.G., Germany

HS-024 760

### CT.-HPR-402

University of Connecticut, Civil Engineering Dept., Storrs, Conn. 06268

HS-024 736

### DEN-3-8

Ford Motor Co., Res. Staff, Dearborn, Mich. 48121

HS-024 607

### DOE-EX-76-A-31-1011

National Aeronautics and Space Administration; California Inst. of Tech., Jet Propulsion Lab., Pasadena, Calif.

HS-024 579

### DOE-EY-76-C-02-2835

Mechanical Technology Inc., Electrical Engineering Dept., 968 Albany-Shaker Rd., Latham, N.Y. 12110

HS-024 728

Mechanical Technology Inc., Electrical Engineering Dept., 968 Albany-Shaker Rd., Latham, N.Y. 12110

HS-024 739

### DOE-W-7405-ENG-26

Oak Ridge National Lab., Oak Ridge, Tenn. 37830; Delta Res. Corp., 1401 Wilson Blvd., Arlington, Va. 22209

HS-024 641

### DOE-W-7405-ENG-48

University of California, Lawrence Livermore Lab., P.O. Box 808, Livermore, Calif. 94550

HS-024 645

### DOT-FH-11-8490

Paul J. Claffey, Consulting Engineers, 26 Grant St., Pot-dam, N.Y. 13676

HS-024 732

### DOT-FH-11-8525

Byrd, Tallamy, MacDonald and Lewis, Falls Church, Va.

HS-024 718

### DOT-FH-11-8834

Alan M. Voorhees and Associates, Inc., 7798 Old Springhouse Rd., McLean, Va. 22101

HS-024 720

### DOT-FH-11-9141

Urban Behavioral Res. Associates, Inc., 3518 Laclede Blvd., St. Louis, Mo. 63103

HS-024 707

### DOT-FH-11-9198

Peat, Marwick, Mitchell and Co., 1025 Connecticut Ave., N.W., Washington, D.C. 20036; Peat, Marwick and Partners, Toronto, Ont., Canada; Casciato, White and Associates, Toronto, Ont., Canada

HS-024 632

### DOT-FH-11-9384

Science Applications, Inc., Energy and Environmental Sciences, 1651 Old Meadow Rd., McLean, Va. 22101

HS-024 691

### DOT-HS-01143

National Public Services Res. Inst., 421 King St., Alexandria, Va. 22314

HS-024 682

### DOT-HS-6-01384

Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017

HS-803 670

### DOT-HS-6-01395

Southwest Res. Inst., 6220 Culebra Rd., San Antonio, Tex. 78284

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Southwest Res. Inst., 6220 Culebra Rd., San Antonio, Tex. 78284

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### DOT-HS-7-01551

Calspan Corp., Calspan Advanced Technology Center, P.O. Box 400, Buffalo, N.Y. 14225

HS-803 765

### DOT-HS-7-01736

Opinion Res. Corp., N. Harrison St., Princeton, N.J. 08540

HS-803 774

### DOT-HS-8-01886, Mod. 1

Dynamic Science, Inc., 1850 W. Pinnacle Peak Rd., Phoenix, Ariz. 85027

HS-803 671

### DOT-TSC-1236

Hazeltine Corp., Greenlawn, N.Y. 11740

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Hazeltine Corp., Greenlawn, N.Y. 11740

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Hazeltine Corp., Greenlawn, N.Y. 11740

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Hazeltine Corp., Greenlawn, N.Y. 11740

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### DOT-TSC-1387

Robert C. Ronstadt Associates, Inc., 46 Glen St., Dover, Mass. 02030

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**DOT-TSC-1419**

Center for the Environment and Man, Inc., 275 Windsor St.,  
Hartford, Conn. 06120

HS-803 537

**Purchase-Order-6-1-0107**

Jet Propulsion Lab., 4800 Oak Grove Drive, Pasadena, Calif.  
91103

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## **CONTRACTS AWARDED**

DOT-HS-4-00921 Mod. 13

## **QUANTIFICATION OF THORACIC RESPONSE AND INJURY**

As part of a research program to investigate the injury protection performance of advanced-design automobile door structures in side impacts, sled tests will be conducted using fully-instrumented human surrogates (anthropomorphic test devices (572, Hybrid III, Repeatable Pete, Sierra S-series Advanced Dummy)) and actual door structures to simulate the subject/door interaction in side impacts. Protection performance will be evaluated based on injury measures previously obtained on Contract DOT-HS-4-00921, as well as other injury assessment standards. The test conditions (sled deceleration profile and door/dummy interaction velocity) will be determined to provide interaction velocities ranging from 5 m/s to 10 m/s. The test dummy will be instrumented with appropriate transducers to monitor the kinematic response of the head, chest, and pelvis. The data will be processed to produce time histories of head motion, rib cage, and pelvis accelerations. These will be analyzed to assess the protection performance of the tested door structure.

The Regents of the University of Michigan, Office of Research Administration, 260 Research Administration Building, Ann Arbor, Michigan 48105  
Increased \$196,385.00  
No change

DOT-HS-8-01933 Mod. 1

## **TEST DEVICE AND TEST PROCEDURE TO ASSESS SIDE STRUCTURES**

Task 2 now shall consist of two barrier collisions using two selected vehicle models, at a 30 degree angle using the load cell moving barrier developed under Contract DOT-HS-7-01758, and a stationary target vehicle (uninstrumented dummies required), the impact speed to be determined to provide adequate deformation of typical front structures in front-to-side impacts. Data from these crash tests and previous tests performed in Contracts DOT-HS-7-01758, DOT-HS-5-01099, and DOT-HS-5-01104 shall be summarized and evaluated. These and other pertinent data shall be gathered and presented in a manner that establishes the upper and lower bounds of the frontal and side structure characteristics of the subcompact, compact, intermediate, and full-size vehicles. The method of presentation also should indicate clearly the scope of requirements for a side impactor test device(s) and appropriate test procedures.

Dynamic Science, Inc., 1850 West Pinnacle Peak Road, Phoenix, Arizona 85027  
No change  
No change

DOT-HS-8-02026 Mod. 1

## **COLLISION DEFORMATION CLASSIFICATION TRAINING PROGRAM**

A system to classify large truck and articulated-vehicle damage which would be acceptable for the National Accident Sampling System program and eventually to the Society of Automotive Engineers, shall be designed; and the Collision Deformation Classification Training Program shall be developed further to include large trucks and articulated vehicles.

Calspan Field Services, Inc., 4455 Genesee Street, Buffalo, New York 14225  
Increased \$25,453.00  
Extended to 30 Nov 79.

DOT-HS-9-02088

## **HEAD INJURY STUDY BY COMPUTED TOMOGRAPH (CT) SCAN TECHNIQUES**

In Phase 1 of an anticipated three-phase program to quantify the relationship of various neuropathological lesions with their importance regarding death or disability in head-injured patients, work shall involve data accession and analysis, and establishment of predictive indices. Phase 1 objectives are as follows: overall description of the study group, documentation of the types of pathological lesions present as well as quantification of their distribution and size, quantitative analysis of the relationship of the Computed Tomograph (CT) scan to various types of injuries, determination of the importance of various lesion types and various combinations of lesion types regarding death and disability, and development of single and multivariant correlations of the ability of the CT scan, alone and with neurological data, to predict death and disability in each of the lesion types.

University of Pennsylvania, Office of Research Administration, 3451 Walnut Street, Philadelphia, Pennsylvania 19104  
\$99,642.00  
To be completed twelve (12) months from date of contract award (29 Mar 79).

DOT-HS-9-02092

## **DEVELOP COMPONENTS OF STATE ON-ROAD LICENSING EXAMINATION**

This two-phase study involves an analysis of state road tests for driver licensure in an initial attempt at objective identification and delineation of human performance parameters relevant to safe vehicle operation, and an attempt to consolidate recent research efforts to develop a valid on-road performance test (ORPT) and operationally determine the feasibility of this new test. The Phase 1 effort will involve a state-of-the-art review of human performance assessment and compilation of behavioral categories relevant to the driving task. The latter task shall include a list of human performance output parameters, definition of potential categories of behavior, development of feasibility criteria for assessing the performance

DOT-HS-9-02117

categories, selection of objective performance measurement techniques, initial development of a modified on-road test, development of a field test design and operation feasibility of the test, and an expert panel review of the previous task results. The Phase 2 effort will be to test the modified on-road performance test in the field. of

National Public Services Research Institute, 123 North Pitt Street, Suite 500, Alexandria, Virginia 22314  
\$143,389.00

To be completed eighteen (18) months from date of contract award (9 Mar 79).

DOT-HS-9-02117

### **IMPACT OF MOTORCYCLE HELMET USAGE IN COLORADO**

Additional data shall be collected in order to study the effect of the repeal of Colorado's mandatory motorcycle helmet use law on motorcycle accident severity and helmet usage. The data shall be collected for accidents occurring under stabilized post-repeal conditions; the period will be Jul 78 through Jun 79. The repeal of the law was effective 20 May 77. All pertinent motorcycle accident data for the one-year period shall be collected from the local police departments and State Highway Patrol in the areas of Boulder, Fort Collins, Grand Junction, Denver, and all state roads under the jurisdiction of the Colorado State Patrol. For every motorcycle accident, an examination shall be made of the medical records (if treatment were required) of the motorcycle rider and passenger. The nature of the injury by body region shall be recorded. The Abbreviated Injury Scale of the individual injury, the Overall Abbreviated Injury Scale, and the Injury Severity Score shall be determined according to revised 1976 standards. Monthly and annual motorcycle statistics and exposure data shall be collected from state and local sources. Surveys shall be conducted on randomly selected site locations to provide sufficient observations on current usage of motorcycle helmets in urban and rural areas of Colorado. All helmet-usage and injury data shall be automated (converted to magnetic tape).0ing

State of Colorado, Division of Highway Safety, 4201 E. Arkansas Avenue, Denver, Colorado 80222  
\$38,534.00

To be completed by 31 Dec 79.

DOT-HS-9-02125

### **STORAGE, PACKAGING AND TRANSPORTATION OF COMPLIANCE TEST EQUIPMENT**

Security storage facility, pickup and delivery, handling, recording, and packaging services shall be provided for automobile and truck tires, and miscellaneous automotive equipment, parts, and components used by the National Hwy. Traffic Safety Administration in its compliance testing program. 0 th

Victory Van Corporation, 950 South Pickett Street, Alexandria, Virginia 22203  
\$18,000.00

1 Dec 78 through 30 Nov 79

HSL 79-07

DOT-HS-9-02128

### **NATIONAL ACCIDENT SAMPLING SYSTEM--NON-REPORTED ACCIDENT SURVEY**

The design of the National Accident Sampling System (NASS) and studies on characteristics of traffic accidents for which a police report is not filed (non-reported accidents) shall be reviewed, a survey of non-reported accidents which will estimate the magnitude of certain required statistics shall be designed and implemented, the relative importance of non-reported accidents to the estimation of key NASS statistics shall be evaluated, and a method for the incorporation of the collection and estimation of non-reported accidents in the existing NASS framework shall be provided.0tat

Westat, Incorporated, 11600 Nebel Street, Rockville, Maryland 20852  
\$418,664.00

To be completed by 19 Jun 81.

DOT-HS-9-02131

### **TIRE MIX PERFORMANCE AND INSPECTION**

Tire lateral performance shall be measured on a sufficient number of tires (passenger, light truck, and van) to determine the range and spectrum density of tire lateral performance currently in the American tire market; the effect of tire mix and low tire inflation pressure on lateral performance relative to stability and control of a light truck, a van, and a front-engine, front-wheel-drive compact passenger vehicle shall be determined using both computer simulation and full-scale vehicle testing. The effect of tire mix and low tire inflation pressure on vehicle stability/control shall be evaluated, and a system shall be derived for measuring as well as classifying tire lateral performance that can be employed easily by consumers and vehicle inspectors. Th

Systems Technology, Inc., 13766 South Hawthorne Boulevard, Hawthorne, Calif. 90250  
\$151,400.00

To be completed fifteen (15) months from date of contract award (23 Mar 79).

DOT-HS-9-02135

### **TECHNICAL ASSISTANCE IN SUPPORT OF 55 MPH NATIONAL MAXIMUM SPEED LIMIT**

Technical assistance shall be provided in planning, implementing, and coordinating a public support program for the 55 mph national maximum speed limit. The work will involve developing a technical plan and conducting a nationwide program of public support through state and Federal government agencies and through private sector groups and commercial firms. On-site consultation regarding public communications in support of the 55 mph speed limit will be provided, orientation programs will be conducted, and continuing support shall be provided by offering technical guidance and by exchanging information among cooperating Federal, state, and private groups.

"This contract is awarded by the Small Business Administration under the authority of Section 8(a) of the Small Business Act (USC 637a), and will be administered by the

July 31, 1979

DOT-HS-9-02158

Department of Transportation, National Highway Traffic  
Safety Administration."

\$99,381.00

To be completed one (1) year from date of contract award (28  
Mar 79).

DOT-HS-9-02158

**PROGRAM DESIGN AND DATA ANALYSIS OF  
SAFETY RELATED DEFECTS INVESTIGATION, ODI  
CASE NUMBER C8-02**

A complete and accurate master file of the information (source  
documents) received by the National Hwy. Traffic Safety Ad-  
ministration from consumers and others concerning the Office  
of Defects Investigation Case No. C8-02 shall be created.  
From this detailed master file, detailed listings shall be  
produced along with summary reports, routine reports, and  
special reports

Control Data Corporation, Professional Services Division,  
6003 Executive Boulevard, Rockville, Maryland 20852

\$129,622.00

20 Apr 79 through 30 Sep 79